

Shop Manual

HYDRAULIC
EXCAVATOR

PC27MR -3

PC30MR -3

PC35MR -3

SERIAL NUMBERS

PC27MR- 20002

PC30MR- 30001

PC35MR- 15001

and up

KOMATSU

HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

00 Index and foreword

100 Index

Composition of shop manual	2
Table of contents	4

Composition of shop manual

The contents of this shop manual are shown together with Form No. in a list.

Note 1: Always keep the latest version of this manual in accordance with this list and utilize accordingly.

The marks shown to the right of Form No. denote the following:

○: New issue (to be filed additionally) ●: Revision (to be replaced for each Form No.)

Note 2: This shop manual can be supplied for each Form No.

Note 3: To file this shop manual in the special binder for management, handle it as follows:

- Place a divider on the top of each section in the file after matching the Tub No. with No. indicated next to each Section Name shown in the table below:
- File overview and other materials in sections in the order shown below and utilize them accordingly.

Section Title	Form Number
Shop Manual, contents binder, binder label and tabs	SEN04063-03
00 Index and foreword	SEN04064-03
100 Index	SEN04065-03 ●
200 Foreword and general information	SEN04066-02
01 Specification	SEN04067-00
100 Specification and technical data	SEN04068-00
10 Structure, function and maintenance standard	SEN04069-02
100 Engine and cooling system	SEN04070-00
200 Power train	SEN04071-00
300 Undercarriage and frame	SEN04072-00
410 Hydraulic system, Part 1	SEN04073-02 ●
420 Hydraulic system, Part 2	SEN04074-00
430 Hydraulic system, Part 3	SEN04075-01 ●
500 Work equipment	SEN04076-00
600 Cab and its attachments	SEN04077-00
700 Electrical system	SEN04078-01
20 Standard value table	SEN04079-00
100 Standard service value table	SEN04380-00
30 Testing and adjusting	SEN04080-01
100 Testing and adjusting	SEN04381-01 ●
40 Troubleshooting	SEN04081-00
100 General information on troubleshooting	SEN04382-00
200 Troubleshooting of electrical system (E-mode)	SEN04383-00
300 Troubleshooting of hydraulic and mechanical system (H-mode)	SEN04384-00
400 Troubleshooting of engine (S-mode)	SEN04385-00
50 Disassembly and assembly	SEN04082-01
100 General information on disassembly and assembly	SEN04386-00
200 Engine and cooling system	SEN04387-00
300 Power train	SEN04388-00

400 Undercarriage and frame	SEN04389-00
500 Hydraulic system	SEN04390-00
600 Work equipment	SEN04391-00
700 Cab and its attachments	SEN04392-00
800 Electrical system	SEN04393-01 ●
90 Diagrams and drawings	SEN04083-02
100 Hydraulic diagrams and drawings	SEN04084-01
200 Electrical diagrams and drawings	SEN04085-02

Table of contents

00 Index and foreword

100 Index	SEN04065-03
Composition of shop manual.....	2
Table of contents	4
200 Foreword and general information	SEN04066-02
Safety notice	2
How to read the shop manual	7
Explanation of terms for maintenance standard.....	9
Handling of electric equipment and hydraulic component.....	11
Handling of connectors newly used for engines.....	20
How to read electric wire code	23
Precautions when carrying out operation.....	26
Method of disassembling and connecting push-pull type coupler	29
Standard tightening torque table	32
Conversion table	36

01 Specification

100 Specification and technical data	SEN04068-00
Specification dimension drawing	2
Working range drawing	3
Specifications	4
Weight table	14
Table of fuel, coolant and lubricants.....	18

10 Structure, function and maintenance standard

100 Engine and cooling system	SEN04070-00
PTO	2
Cooling system.....	4
200 Power train	SEN04071-00
Power train	2
Swing circle	4
Swing machinery	5
300 Undercarriage and frame	SEN04072-00
Track frame	2
Idler cushion.....	3
Idler	4
Track roller	6
Carrier roller	7
Sprocket	8
Track shoe.....	9
410 Hydraulic system, Part 1	SEN04073-02
Hydraulic components layout drawing	2
Hydraulic tank, filter.....	3
Center swivel joint	5
Travel motor	7
Hydraulic cylinder.....	15
Solenoid valve.....	20
Multi-control valve	26
420 Hydraulic system, Part 2	SEN04074-00
Hydraulic pump	2
Control valve	18

430 Hydraulic system, Part 3	SEN04075-01
CLSS	2
Operation for each function and valve	6
Swing motor	46
PPC valve	51
500 Work equipment	SEN04076-00
Work equipment	2
Dimensions of each part of work equipment	6
600 Cab and its attachments	SEN04077-00
Floor	2
Air conditioner	3
700 Electrical system	SEN04078-01
Engine control system	2
Electric control system	6
Auto-deceleration function	16
Attachment proportional switch, breaker operation switch, work mode selection, flow control function	20
KOMTRAX system	30
Component parts of system	33
Monitor system	34
Sensors	38
20 Standard value table	
100 Standard service value table	SEN04380-00
Standard service value table for engine related parts	2
Standard service value table for chassis related parts	4
30 Testing and adjusting	
100 Testing and adjusting	SEN04381-01
Tools for testing, adjusting, and troubleshooting	3
Testing engine speed	6
Testing exhaust gas color	7
Testing and adjusting valve clearance	8
Testing compression pressure	9
Testing engine oil pressure	10
Testing and adjusting fuel injection timing	11
Testing and adjusting alternator belt tension	15
Testing and adjusting air conditioner compressor belt tension	16
Adjusting fuel control lever	17
Testing clearance in swing circle bearings	18
Testing and adjusting track shoe tension	19
Testing and adjusting oil pressures in work equipment, travel, boom swing, swing, and blade circuits	20
Testing and adjusting LS differential pressure	25
Adjusting PC valve	28
Testing and adjusting control pump circuit oil pressure	29
Testing solenoid valve output pressure	31
Testing PPC valve output pressure	32
Adjusting PPC valve	36
Testing swing holding brake release pressure	37
Testing and adjusting travel deviation	38
Testing oil leakage from work equipment cylinder	40
Bleeding air from each part	42
Releasing residual pressure from hydraulic circuit	44
Releasing residual pressure from hydraulic tank	45
Pressurizing hydraulic tank	45
How to open and close (tilt) floor	46
Inspection procedures for diode	51
How to start operation of KOMTRAX terminal	52

Lamp display of KOMTRAX terminal	56
Removal and installation of KOMTRAX terminal	59
Preparation work for troubleshooting of electrical system.....	60
40 Troubleshooting	
100 General information on troubleshooting	SEN04382-00
Points to remember when troubleshooting.....	2
Sequence of events in troubleshooting	3
Checks before troubleshooting	4
Classification and procedures of troubleshooting	5
Information contained in troubleshooting table	6
Connection table for connector pin numbers	10
T- branch box and T- branch adapter table	46
200 Troubleshooting of electrical system (E-mode)	SEN04383-00
Before carrying out troubleshooting of electrical system.....	2
E-1 Engine does not start.....	4
E-2 Engine does not stop.....	12
E-3 When starting switch is turned ON, any item does not operate.....	14
E-4 When starting switch is turned ON, some items do not operate.....	16
E-5 Alarm buzzer is abnormal.....	17
E-6 Engine oil pressure caution is turned ON.....	19
E-7 Charge level caution is turned ON.....	20
E-8 Preheating system does not operate or preheater does not become hot.....	22
E-9 Coolant temperature gauge is abnormal	24
E-10 Fuel level gauge is abnormal.....	28
E-11 Service meter does not operate while engine is running.....	32
E-12 2nd travel speed is not selected	34
E-13 Working lamp does not light up	38
E-14 When work equipment lock (PPC basic pressure lock) lever is set in LOCK, work equipment still moves.....	40
E-15 Windshield wiper does not operate	42
E-16 Windshield washer does not operate	44
E-17 Defective air conditioner	46
300 Troubleshooting of hydraulic and mechanical system (H-mode)	SEN04384-00
Information contained in troubleshooting table	3
H1 Speed or power of whole work equipment, travel, swing, and blade is low.....	4
H-2 Engine speed lowers extremely or engine stalls	8
H-3 Whole work equipment, travel system, swing system, and blade do not work.....	9
H-4 Abnormal sound comes out from around hydraulic pump.....	13
H-5 Fine control performance or response is low	13
H-6 Speed or power of boom is low	14
H-7 Speed or power of arm is low.....	15
H-8 Speed or power of bucket is low.....	16
H-9 Speed or power of boom swing is low	17
H-10 Work equipment does not move singly	17
H-11 Work equipment hydraulic drift is large.....	18
H-12 Time lag of work equipment is large.....	20
H-13 In compound operation of work equipment, speed of part loaded more is low	20
H-14 Machine deviates during travel.....	21
H-15 Travel speed or travel power is low (while work equipment is normal)	23
H-16 Machine is not steered well or steering power is low	24
H-17 Travel speed does not change	25
H-18 Travel motor does not work.....	26
H-19 Speed or power of swing is low	28
H-20 Machine does not swing.....	30
H-21 Swing acceleration performance is low	32
H-22 Machine overruns when it stops swinging.....	34

H-23 Large shock is made when machine stops swinging	35
H-24 When upper structure stops swinging, it makes large sound	35
H-25 Hydraulic drift of swing is large	36
H-26 Speed or power of blade is low	37
H-27 Blade does not move	38
H-28 Hydraulic drift of blade is large	39
400 Troubleshooting of engine (S-mode)	SEN04385-00
Method of using troubleshooting charts	3
S-1 Starting performance is poor	6
S-2 Engine does not start	7
S-3 Engine does not pick up smoothly	10
S-4 Engine stops during operations	11
S-5 Engine does not rotate smoothly	12
S-6 Engine lacks output (or lacks power)	13
S-7 Exhaust smoke is black (incomplete combustion)	14
S-8 Oil consumption is excessive (or exhaust smoke is blue)	15
S-9 Oil becomes contaminated quickly	16
S-10 Fuel consumption is excessive	17
S-11 Oil is in coolant (or coolant spurts back or coolant level goes down)	18
S-12 Oil pressure drops	19
S-13 Oil level rises (Entry of coolant/fuel)	20
S-14 Coolant temperature becomes too high (overheating)	21
S-15 Abnormal noise is made	22
S-16 Vibration is excessive	23
50 Disassembly and assembly	
100 General information on disassembly and assembly	SEN04386-00
How to read this manual	2
Coating materials list	4
Special tool list	7
Sketches of special tools	11
200 Engine and cooling system	SEN04387-00
Removal and installation of fuel injection pump assembly	2
Removal and installation of radiator and hydraulic oil cooler assembly	5
Removal and installation of engine and hydraulic pump assembly	9
300 Power train	SEN04388-00
Removal and installation of swing motor and swing machinery assembly	2
Disassembly and assembly of swing motor and swing machinery assembly	3
Removal and installation of swing circle assembly	8
400 Undercarriage and frame	SEN04389-00
Removal and installation of track shoe assembly	2
Disassembly and assembly of idler assembly	3
Disassembly and assembly of recoil spring assembly	5
Disassembly and assembly of track roller assembly	8
Disassembly and assembly of carrier roller assembly	9
Removal and installation of revolving frame assembly	10
500 Hydraulic system	SEN04390-00
Removal and installation of center swivel joint assembly	2
Disassembly and assembly of center swivel joint assembly	4
Disassembly and assembly of control valve assembly	6
Disassembly and assembly of hydraulic cylinder assembly	7
600 Work equipment	SEN04391-00
Removal and installation of work equipment assembly	2

700 Cab and its attachments	SEN04392-00
Removal and installation of operator's cab glass (stuck glass).....	2
Removal and installation of front window assembly.....	11
Removal and installation of floor frame assembly.....	12
800 Electrical system	SEN04393-01
Removal and installation of air conditioner unit assembly (If equipped)	2
90 Diagrams and drawings	
100 Hydraulic diagrams and drawings	SEN04084-01
Hydraulic circuit diagram.....	3
200 Electrical diagrams and drawings	SEN04085-02
Electrical circuit diagram	3
Connector list and stereogram	11

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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00 Index and foreword

200 Foreword and general information


Safety notice	2
How to read the shop manual	7
Explanation of terms for maintenance standard	9
Handling of electric equipment and hydraulic component	11
Handling of connectors newly used for engines	20
How to read electric wire code	23
Precautions when carrying out operation	26
Method of disassembling and connecting push-pull type coupler	29
Standard tightening torque table	32
Conversion table	36

Safety notice


(Rev. 2008/08)

Important safety notice

Proper service and repair are extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol  is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

1. General precautions

 **Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully before operating the machine. In addition, read this manual and understand its contents before starting the work.**

- 1) Before carrying out any greasing or repairs, read all the safety labels stuck to the machine. For the locations of the safety labels and detailed explanation of precautions, see the Operation and Maintenance Manual.
- 2) Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt, water, or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.
- 3) When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
 - Always wear safety glasses when hitting parts with a hammer.
 - Always wear safety glasses when grinding parts with a grinder, etc.
- 4) When carrying out any operation with 2 or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR warning signs in the operator's compartment.
- 5) Only qualified workers must carry out work and operation which require license or qualification.
- 6) Keep all tools in good condition, learn the correct way to use them, and use the proper ones of them. Before starting work, thoroughly check the tools, machine, forklift, service car, etc.

- 7) If welding repairs are needed, always have a trained and experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, shielding goggles, cap and other clothes suited for welding work.
- 8) Before starting work, warm up your body thoroughly to start work under good condition.
- 9) Avoid continuing work for long hours and take rests at proper intervals to keep your body in good condition. Take rests in specified safe places.

Safety points

1	Good arrangement
2	Correct work clothes
3	Following work standard
4	Making and checking signs
5	Prohibition of operation and handling by unlicensed workers
6	Safety check before starting work
7	Wearing protective goggles (for cleaning or grinding work)
8	Wearing shielding goggles and protectors (for welding work)
9	Good physical condition and preparation
10	Precautions against work which you are not used to or you are used to too much

2. Preparations for work

- 1) Before adding oil or making any repairs, park the machine on a hard and level ground, and apply the parking brake and block the wheels or tracks to prevent the machine from moving.
- 2) Before starting work, lower the work equipment (blade, ripper, bucket, etc.) to the ground. If this is not possible, insert the lock pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
- 3) When disassembling or assembling, support the machine with blocks, jacks, or stands before starting work.
- 4) Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

3. Precautions during work

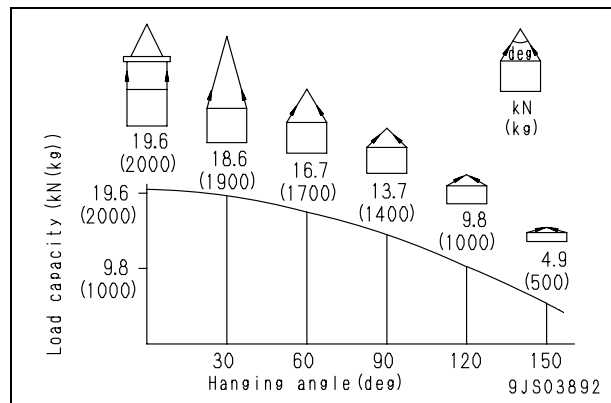
- 1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
- 2) The coolant and oil in the circuits are hot when the engine is stopped, so be careful not to get scalded. Wait for the oil and coolant to cool before carrying out any work on the oil or water circuits.
- 3) Before starting work, stop the engine. When working on or around a rotating part, in particular, stop the engine. When checking the machine without stopping the engine (measuring oil pressure, revolving speed, temperature, etc.), take extreme care not to get rolled or caught in rotating parts or moving parts.
- 4) Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
- 5) When raising a heavy component (heavier than 25 kg), use a hoist or crane. Before starting work, check that the slings (wire ropes, chains, and hooks) are free from damage. Always use slings which have ample capacity and install them to proper places. Operate the hoist or crane slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
- 6) When removing a cover which is under internal pressure or under pressure from a spring, always leave 2 bolts in diagonal positions. Loosen those bolts gradually and alternately to release the pressure, and then remove the cover.
- 7) When removing components, be careful not to break or damage the electrical wiring. Damaged wiring may cause electrical fires.
- 8) When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip and can even start fires.
- 9) As a general rule, do not use gasoline to wash parts. Do not use it to clean electrical parts, in particular.
- 10) Be sure to assemble all parts again in their original places. Replace any damaged parts and parts which must not be reused with new parts. When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is operated.
- 11) When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. In addition, check that connecting parts are correctly installed.
- 12) When assembling or installing parts, always tighten them to the specified torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
- 13) When aligning 2 holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
- 14) When measuring hydraulic pressure, check that the measuring tools are correctly assembled.
- 15) Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.
- 16) If the engine is operated for a long time in a place which is not ventilated well, you may suffer from gas poisoning. Accordingly, open the windows and doors to ventilate well.

4. Precautions for sling work and making signs

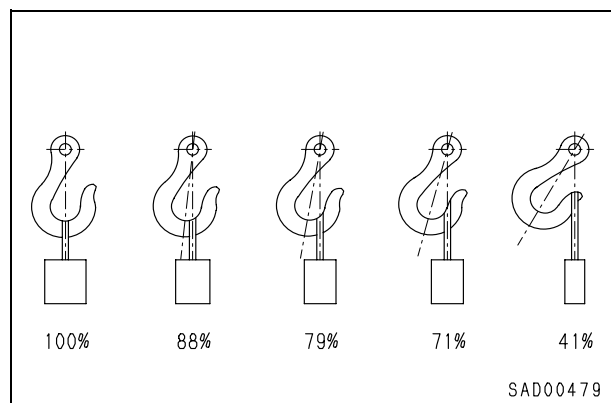
- 1) Only one appointed worker must make signs and co-workers must communicate with each other frequently. The appointed sign maker must make specified signs clearly at a place where he is well seen from the operator's seat and where he can see the working condition easily. The sign maker must always stand in front of the load and guide the operator safely.
 - Do not stand under the load.
 - Do not step on the load.
- 2) Check the slings before starting sling work.
- 3) Keep putting on gloves during sling work. (Put on leather gloves, if available.)
- 4) Measure the weight of the load by the eye and check its center of gravity.
- 5) Use proper sling according to the weight of the load and method of slinging. If too thick wire ropes are used to sling a light load, the load may slip and fall.
- 6) Do not sling a load with 1 wire rope alone. If it is slung so, it may rotate and may slip out of the rope. Install 2 or more wire ropes symmetrically.

⚠ Slinging with 1 rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

- 7) Limit the hanging angle to 60°, as a rule. Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with 2 or more ropes, the force subjected to each rope will increase with the hanging angle. The table below shows the variation of allowable load in kN {kg} when hoisting is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1,000 kg} vertically, at various hanging angles. When the 2 ropes sling a load vertically, up to 19.6 kN {2,000 kg} of total weight can be suspended. This weight is reduced to 9.8 kN {1,000 kg} when the 2 ropes make a hanging angle of 120°. If the 2 ropes sling a 19.6 kN {2,000 kg} load at a lifting angle of 150°, each of them is subjected to a force as large as 39.2 kN {4,000 kg}.



- 8) When installing wire ropes to an angular load, apply pads to protect the wire ropes. If the load is slippery, apply proper material to prevent the wire rope from slipping.
- 9) Use the specified eyebolts and fix wire ropes, chains, etc. to them with shackles, etc.
- 10) Apply wire ropes to the middle portion of the hook.
 - Slinging near the tip of the hook may cause the rope to slip off the hook during hoisting. The hook has the maximum strength at the middle portion.




- 11) Do not use twisted or kinked wire ropes.
- 12) When lifting up a load, observe the following.
 - Wind in the crane slowly until wire ropes are stretched. When settling the wire ropes with the hand, do not grasp them but press them from above. If you grasp them, your fingers may be caught.
 - After the wire ropes are stretched, stop the crane and check the condition of the slung load, wire ropes, and pads.

- If the load is unstable or the wire rope or chains are twisted, lower the load and lift it up again.
 - Do not lift up the load slantingly.
- 13) When lifting down a load, observe the following.
- When lifting down a load, stop it temporarily at 30 cm above the floor, and then lower it slowly.
 - Check that the load is stable, and then remove the sling.
 - Remove kinks and dirt from the wire ropes and chains used for the sling work, and put them in the specified place.

5. Precautions for using mobile crane

- ★ Read the Operation and Maintenance Manual of the crane carefully in advance and operate the crane safely.

6. Precautions for using overhead hoist crane

⚠ When raising a heavy part (heavier than 25 kg), use a hoist, etc. In Disassembly and assembly, the weight of a part heavier than 25 kg is indicated after the mark of .

- 1) Before starting work, inspect the wire ropes, brake, clutch, controller, rails, over wind stop device, electric shock prevention earth leakage breaker, crane collision prevention device, and power application warning lamp, and check safety.
- 2) Observe the signs for sling work.
- 3) Operate the hoist at a safe place.
- 4) Check the direction indicator plates (east, west, south, and north) and the directions of the control buttons without fail.
- 5) Do not sling a load slantingly. Do not move the crane while the slung load is swinging.
- 6) Do not raise or lower a load while the crane is moving longitudinally or laterally.
- 7) Do not drag a sling.
- 8) When lifting up a load, stop it just after it leaves the ground and check safety, and then lift it up.
- 9) Consider the travel route in advance and lift up a load to a safe height.
- 10) Place the control switch on a position where it will not be an obstacle to work and passage.
- 11) After operating the hoist, do not swing the control switch.
- 12) Remember the position of the main switch so that you can turn off the power immediately in an emergency.

- 13) If the hoist stops because of a power failure, turn the power switch OFF. When turning on a switch which was turned OFF by the electric shock prevention earth leakage breaker, check that the devices related to that switch are not in operation state.
- 14) If you find an obstacle around the hoist, stop the operation.
- 15) After finishing the work, stop the hoist at the specified position and raise the hook to at least 2 m above the floor. Do not leave the sling installed to the hook.

7. Selecting wire ropes

- 1) Select adequate ropes depending on the weight of parts to be hoisted, referring to the table below.

Wire ropes
(Standard "Z" twist ropes without galvanizing)
(JIS G3525, No. 6, Type 6X37-A)

Nominal diameter of rope	Allowable load	
	kN	ton
10	8.8	0.9
12	12.7	1.3
14	17.3	1.7
16	22.6	2.3
18	28.6	2.9
20	35.3	3.6
25	55.3	5.6
30	79.6	8.1
40	141.6	14.4
50	221.6	22.6
60	318.3	32.4

- ★ The allowable load is one-sixth of the breaking strength of the rope used (Safety coefficient: 6).

8. Precautions for disconnecting and connecting hoses and tubes in air conditioner circuit

1) Disconnection

⚠ For the environment, the air conditioner of this machine uses the refrigerant (air conditioner gas: R134a) which has fewer factors of the depletion of the ozone layer. However, it does not mean that you may discharge the refrigerant into the atmosphere as it is. Be sure to recover the refrigerant when disconnecting the refrigerant gas circuit and then reuse it.

★ Ask professional traders for collecting and filling operation of refrigerant (R134a).

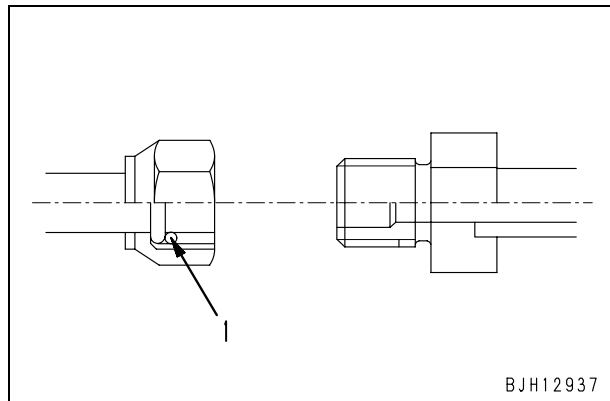
★ Never release the refrigerant (R134a) to the atmosphere.

⚠ If the refrigerant gas gets in your eyes or contacts your skin, you may lose your sight and your skin may be frozen. Accordingly, put on safety glasses, safety gloves and safety clothes when recovering or adding the refrigerant. Refrigerant gas must be recovered and added by a qualified person.

2) Connection

- 1] When installing the air conditioner circuit hoses and tubes, take care that dirt, dust, water, etc. will not enter them.
- 2] When connecting the air conditioner hoses and tubes, check that O-rings (1) are fitted to their joints.
- 3] Check that each O-ring is not damaged or deteriorated.
- 4] When connecting the refrigerant piping, apply compressor oil for refrigerant (R134a) (**DENSO: ND-OIL8, VALEO THERMAL SYSTEMS: ZXL100PG (equivalent to PAG46)**) to its O-rings.

★ Example of O-ring (Fitted to every joint of hoses and tubes)



★ For tightening torque, see the precautions for installation in each section of "Disassembly and assembly".

How to read the shop manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult KOMATSU distributors.
- Materials and specifications are subject to change without notice.
- Shop manuals are divided into the “Chassis volume” and “Engine volume”. For the engine unit, see the engine volume of the engine model mounted on the machine.

1. Composition of shop manual

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

00. Index and foreword

This section explains the shop manuals list, table of contents, safety, and basic information.

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

This section explains the structure, function, and maintenance standard values of each component. The structure and function sub-section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting. The maintenance standard sub-section explains the criteria and remedies for disassembly and service.

20. Standard value table

This section explains the standard values for new machine and judgement criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

30. Testing and adjusting

This section explains measuring instruments and measuring methods for testing and adjusting, and method of adjusting each part. The standard values and judgement criteria for testing and adjusting are explained in Testing and adjusting.

40. Troubleshooting

This section explains how to find out failed parts and how to repair them. The troubleshooting is divided by failure modes. The “S mode” of the troubleshooting related to the engine may be also explained in the Chassis volume and Engine volume. In this case, see the Chassis volume.

50. Disassembly and assembly

This section explains the special tools and procedures for removing, installing, disassembling, and assembling each component, as well as precautions for them. In addition, tightening torque and quantity and weight of coating material, oil, grease, and coolant necessary for the work are also explained.

90. Diagrams and drawings (chassis volume)/Repair and replacement of parts (engine volume)

- Chassis volume
This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
This section explains the method of reproducing, repairing, and replacing parts.

2. Revision and distribution

Any additions, revisions, or other change of notices will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

3. Filing method

File by the brochures in the correct order of the form number printed in the shop manual composition table.

- **Revised edition mark**








When a manual is revised, the ones and tens digits of the form number of each brochure is increased by 1. (Example: 00, 01, 02 ...)

- **Revisions**

Revised brochures are shown in the shop manual composition table.

4. Symbols

Important safety and quality portions are marked with the following symbols so that the shop manual will be used practically.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing work.
	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing work.
	Weight	Weight of parts of component or parts. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives, etc. during assembly.
	Oil, coolant	Places where oil, etc. must be added, and capacity.
	Drain	Places where oil, etc. must be drained, and quantity to be drained.

5. Units

In this shop manual, the units are indicated with International System of units (SI). For reference, conventionally used Gravitational System of units is indicated in parentheses { }.

Explanation of terms for maintenance standard

The maintenance standard chapter explains the criteria for replacing or reusing products and parts in the machine maintenance work. The following terms are used to explain the criteria.

1. Standard size and tolerance

- To be accurate, the finishing size of parts is a little different from one to another.
- To specify a finishing size of a part, a temporary standard size is set and an allowable difference from that size is indicated.
- The above size set temporarily is called the “standard size” and the range of difference from the standard size is called the “tolerance”.
- The tolerance with the symbols of + or – is indicated on the right side of the standard size.

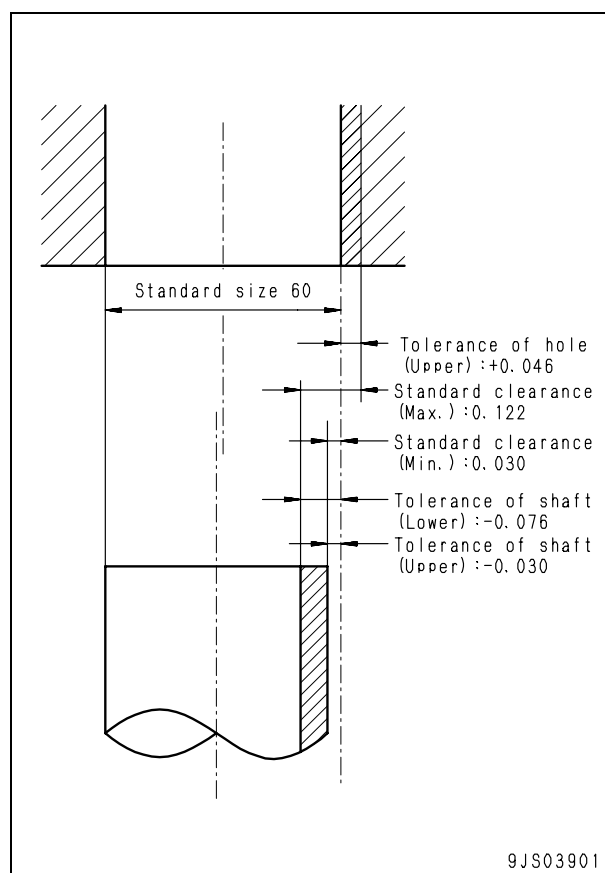
Example:

Standard size	Tolerance
120	–0.022 –0.126

- ★ The tolerance may be indicated in the text and a table as [standard size (upper limit of tolerance/lower limit of tolerance)].
Example) 120 (–0.022/–0.126)
- Usually, the size of a hole and the size of the shaft to be fitted to that hole are indicated by the same standard size and different tolerances of the hole and shaft. The tightness of fit is decided by the tolerance.
- Indication of size of rotating shaft and hole and relationship drawing of them

Example:

Standard size	Tolerance	
	Shaft	Hole
60	–0.030 –0.076	+0.046 0



2. Standard clearance and standard value

- The clearance made when new parts are assembled is called the "standard clearance", which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- A value of performance and function of new products or equivalent is called the "standard value", which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/function is set to the standard value.

3. Standard interference

- When the diameter of a hole of a part shown in the given standard size and tolerance table is smaller than that of the mating shaft, the difference between those diameters is called the "interference".
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the hole to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the "standard interference".
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value or allowable dimension

- The size of a part changes because of wear and deformation while it is used. The limit of changed size is called the "repair limit".
- If a part is worn to the repair limit, it must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value which the product can be used without causing a problem is called the "allowable value" or "allowable dimension".
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

5. Clearance limit

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called the "clearance limit".
- If the clearance between the parts exceeds the clearance limit, they must be replaced or repaired.

6. Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the "interference limit".
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

Handling of electric equipment and hydraulic component

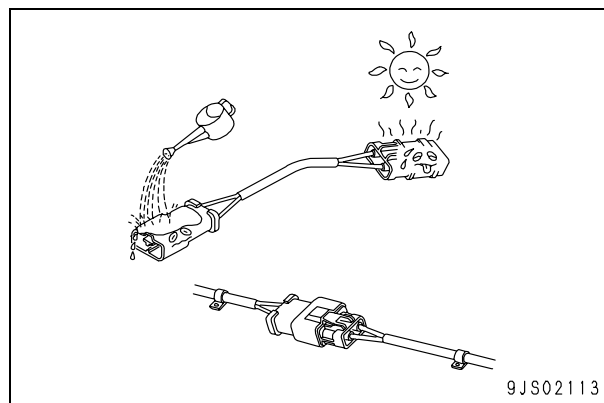
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation”, “maintenance and inspection”, “troubleshooting”, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on “Handling electric equipment” and “Handling hydraulic equipment” (particularly gear oil and hydraulic oil).

Points to remember when handling electric equipment

1. Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

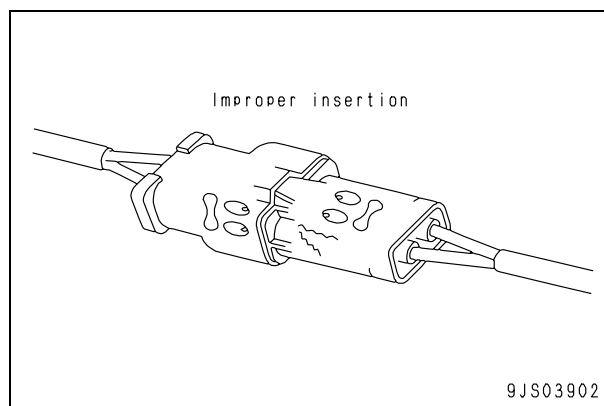
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



2. Main failures occurring in wiring harness

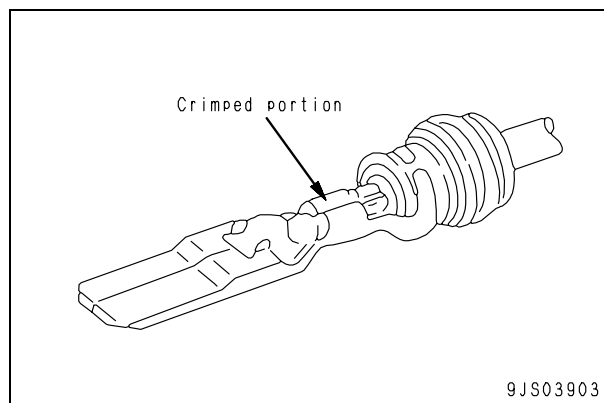
1) Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces. The corroded or oxidized contact surfaces may become shiny again (and contact may become normal) by connecting and disconnecting the connector about 10 times.



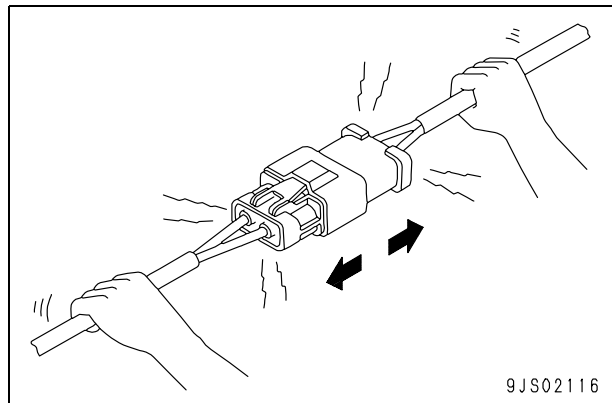
2) Defective crimping or soldering of connectors

The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



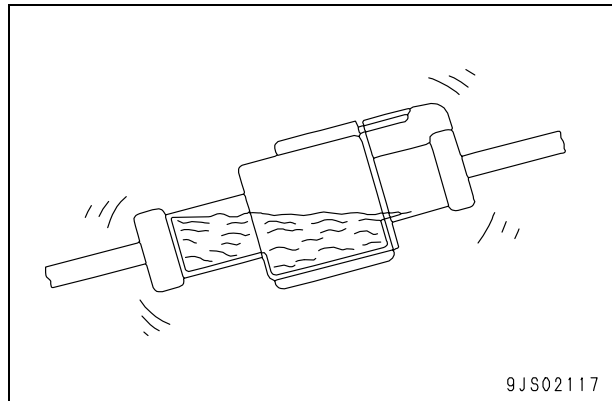
3) Disconnections in wiring

If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



4) High-pressure water entering connector

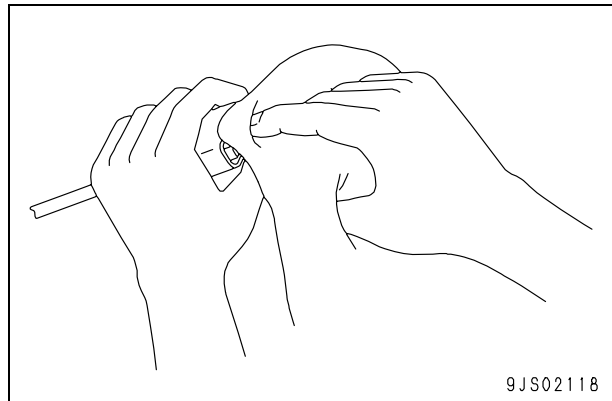
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet. Accordingly, take care not to splash water over the connector. The connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



5) Oil or dirt stuck to connector

If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.

- ★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
- ★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.



3. Removing, installing, and drying connectors and wiring harnesses

1) Disconnecting connectors

- 1] Hold the connectors when disconnecting.

When disconnecting the connectors, hold the connectors. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.

★ Never pull with one hand.

- 2] When removing from clips

- Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.

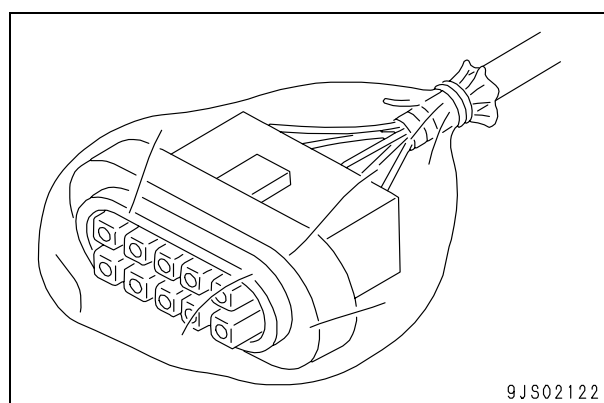
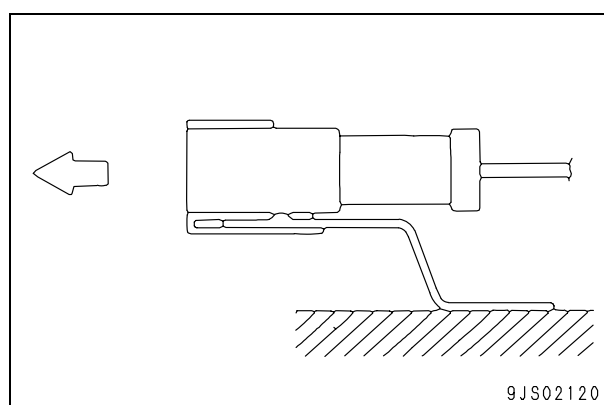
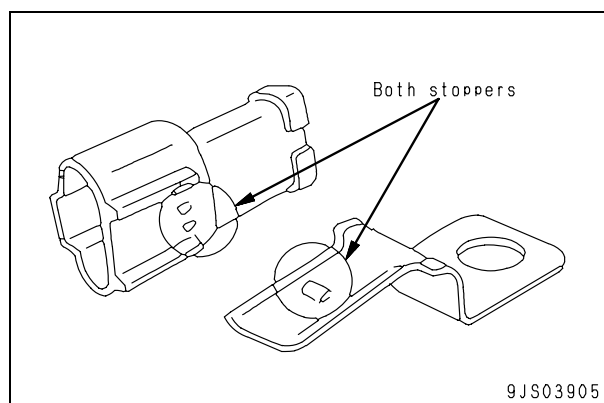
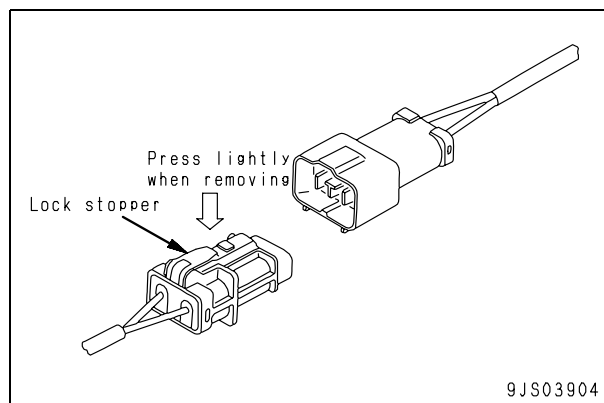
- When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.

★ If the connector is twisted up and down or to the left or right, the housing may break.

- 3] Action to take after removing connectors

After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.

★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



2) Connecting connectors

1] Check the connector visually.

Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).

Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.

Check that there is no damage or breakage to the outside of the connector.

★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.

★ If there is any damage or breakage, replace the connector.

2] Fix the connector securely.

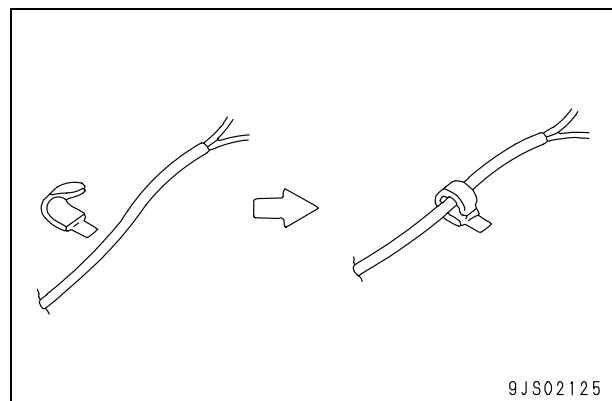
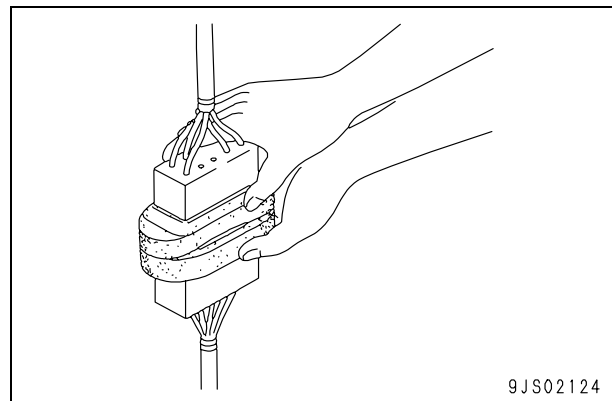
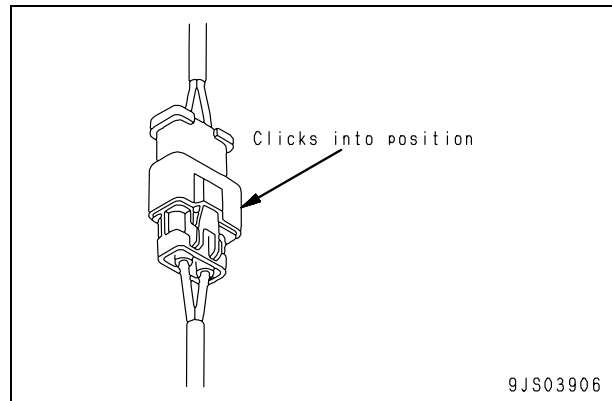
Align the position of the connector correctly, and then insert it securely. For connectors with the lock stopper, push in the connector until the stopper clicks into position.

3] Correct any protrusion of the boot and any misalignment of the wiring harness.

For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

● If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.



3) Heavy duty wire connector (DT 8-pole, 12-pole)

Disconnection (Left of figure)

While pressing both sides of locks (a) and (b), pull out female connector (2).

Connection (Right of figure)

1] Push in female connector (2) horizontally until the lock clicks.

Arrow: 1)

2] Since locks (a) and (b) may not be set completely, push in female connector (2) while moving it up and down until the locks are set normally.

Arrow: 1), 2), 3)

★ Right of figure: Lock (a) is pulled down (not set completely) and lock (b) is set completely.

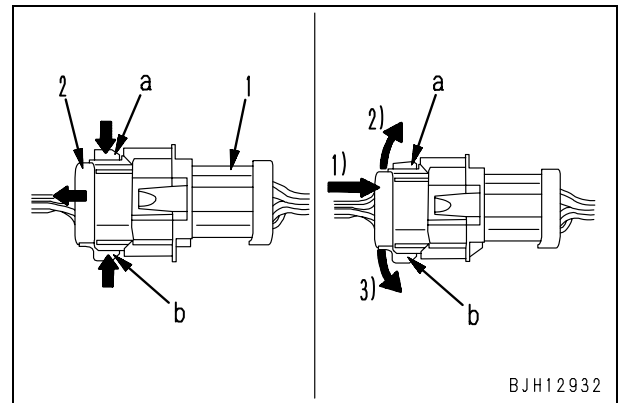
(1): Male connector

(2): Female connector

(a), (b): Locks

• Disconnection

• Connection (Example of incomplete setting of (a))



4) Drying wiring harness

If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness. If water gets directly on the connector, do as follows.

- 1] Disconnect the connector and wipe off the water with a dry cloth.

★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.

- 2] Dry the inside of the connector with a dryer.

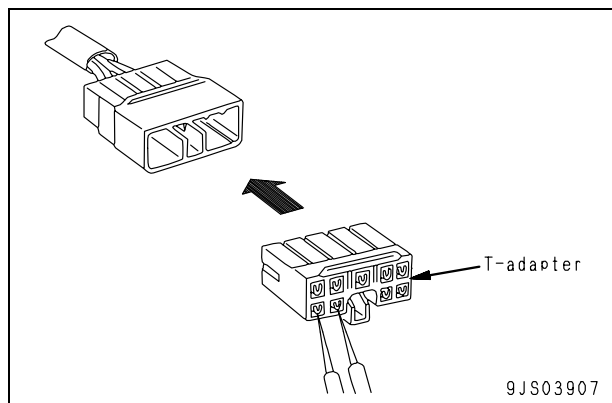
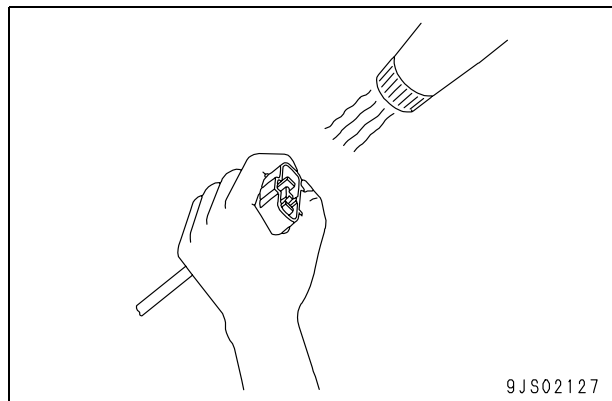
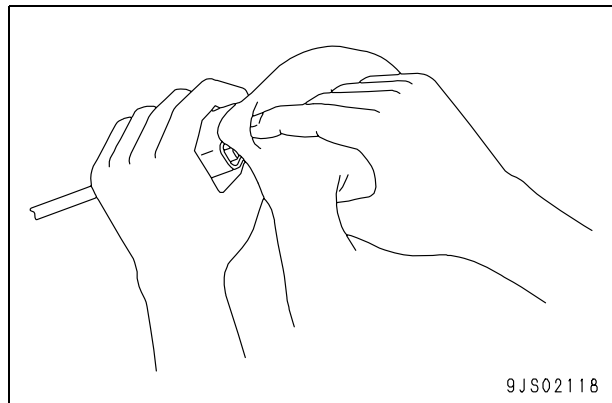
If water gets inside the connector, use a dryer to dry the connector.

★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

- 3] Carry out a continuity test on the connector.

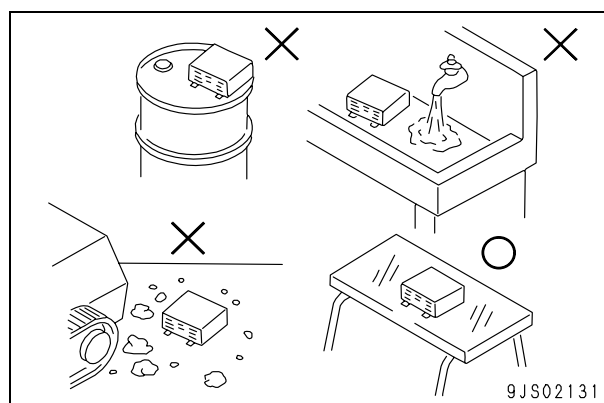
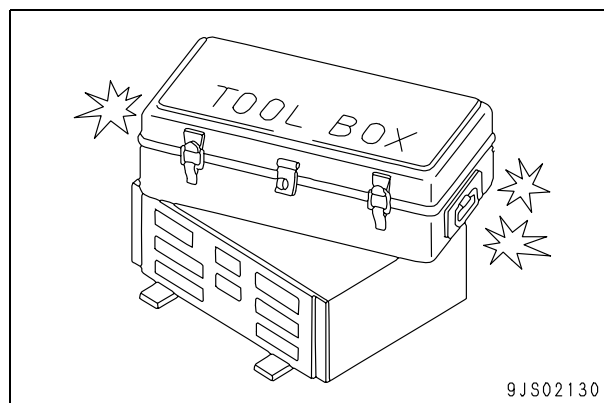
After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.

★ After completely drying the connector, blow it with contact restorer and reassemble.



4. Handling controller

- 1) The controller contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the controller.
- 2) Do not place objects on top of the controller.
- 3) Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
- 4) During rainy weather, do not leave the controller in a place where it is exposed to rain.
- 5) Do not place the controller on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
- 6) Precautions when carrying out arc welding
When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the controller. Fit an arc welding ground close to the welding point.



5. Points to remember when troubleshooting electric circuits

- 1) Always turn the power OFF before disconnecting or connecting connectors.
- 2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Disconnect and connect the related connectors several times to check.
- 3) Always connect any disconnected connectors before going on to the next step.
 - ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
- 4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
 - ★ If there is any change, there is probably defective contact in that circuit.

Points to remember when handling hydraulic equipment

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1. Be careful of the operating environment.

Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

2. Disassembly and maintenance work in the field

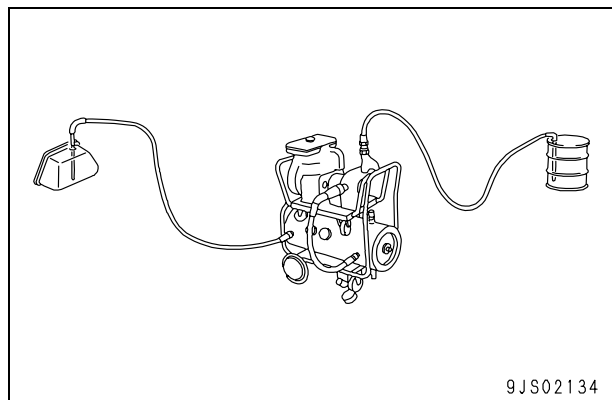
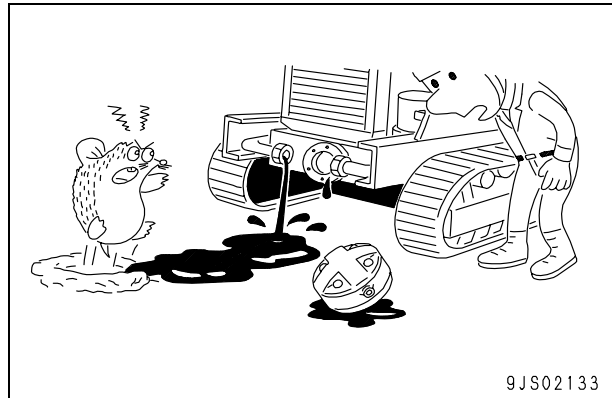
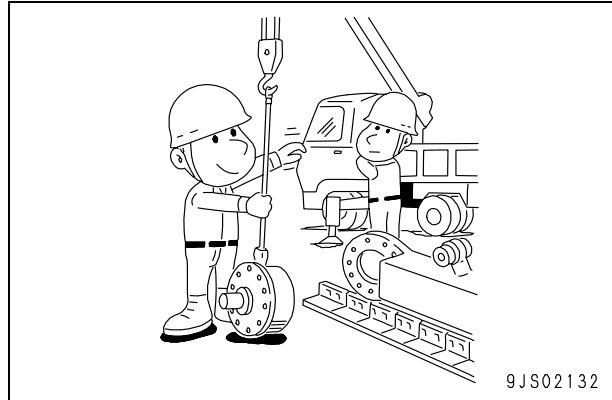
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be checked with special test equipment.

3. Sealing openings

After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out onto the ground, but collect it and ask the customer to dispose of it, or take it back with you for disposal.

4. Do not let any dirt or dust get in during refilling operations

Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.

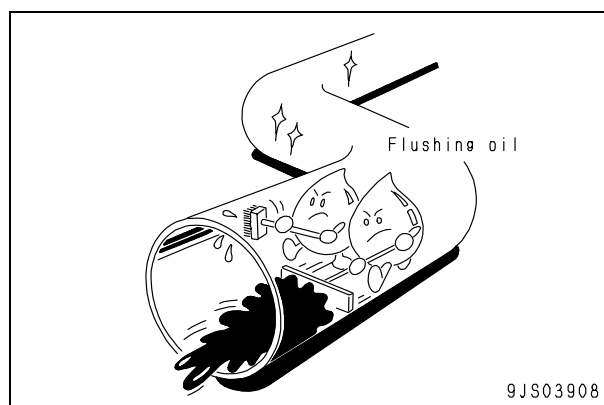


5. Change hydraulic oil when the temperature is high

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

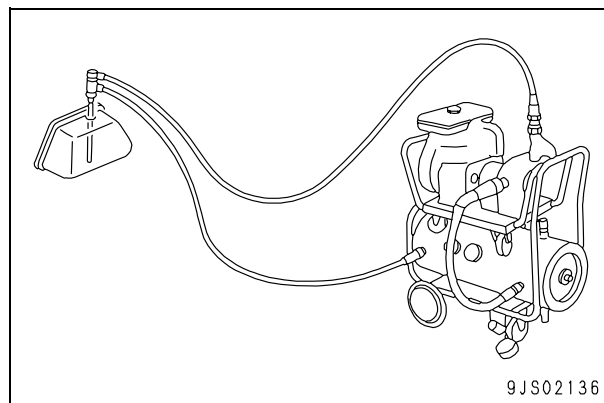
6. Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit. Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



7. Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultra fine (about 3 μ) particles that the filter built in the hydraulic equipment cannot remove, so it is an extremely effective device.



Handling of connectors newly used for engines

- ★ Mainly, following engines are object for following connectors.

- 95E-5
- 107E-1
- 114E-3
- 125E-5
- 140E-5
- 170E-5
- 12V140E-3

1. Slide lock type (FRAMATOME-3, FRAMATOME-2)

- 95 – 170, 12V140 engines
 - Various pressure sensors and NE speed sensor

Examples)

Intake air pressure sensor in intake manifold: PIM

(125, 170, 12V140 engines)

Oil pressure sensor: POIL

(125, 170, 12V140 engines)

Oil pressure switch

(95, 107, 114 engines)

Ne speed sensor of flywheel housing:

NE (95 – 170, 12V140 engines)

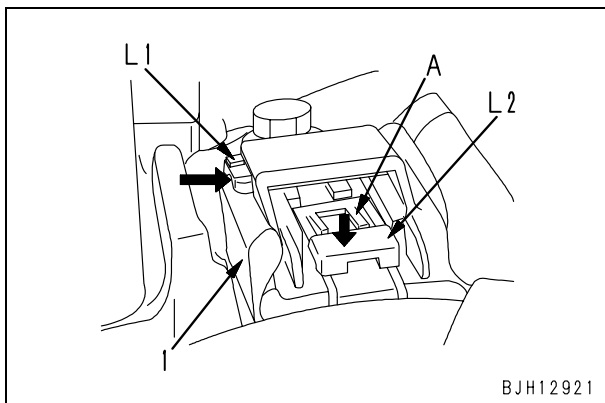
Ambient pressure sensor: PAMB

(125, 170, 12V140 engines)

Disconnect connector (1) according to the following procedure.

- 1) Slide lock (L1) to the right.
- 2) While pressing lock (L2), pull out connector (1) toward you.

- ★ Even if lock (L2) is pressed, connector (1) cannot be pulled out toward you, if part A does not float. In this case, float part A with a small screwdriver while press lock (L2), and then pull out connector (1) toward you.



2. Pull lock type (PACKARD-2)

- 95 – 170, 12V140 engines
 - Various temperature sensors

Example)

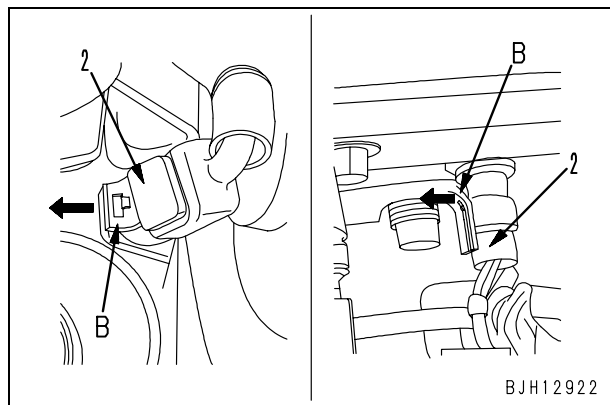
Intake air temperature sensor in intake manifold: TIM

Fuel temperature sensor: TFUEL

Oil temperature sensor: TOIL

Coolant temperature sensor: TWTR, etc.

Disconnect the connector by pulling lock (B) (on the wiring harness side) of connector (2) outward.



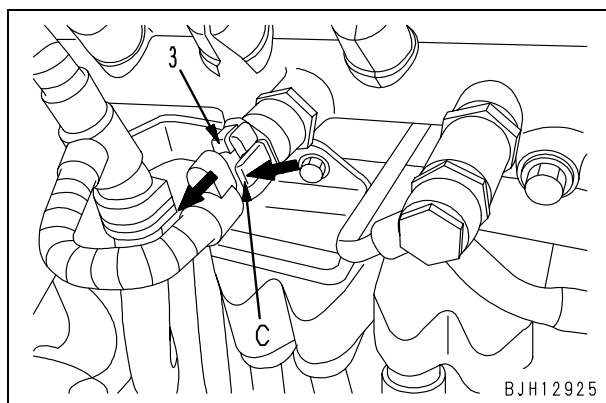
3. Push lock type

- 95, 107, 114 engines
Example)
Fuel pressure sensor in common rail
(**BOSCH-03**)

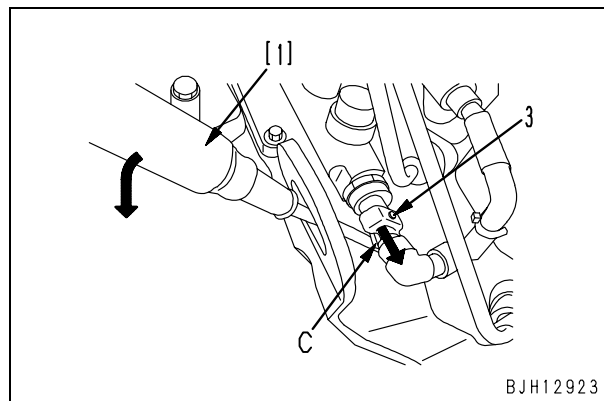
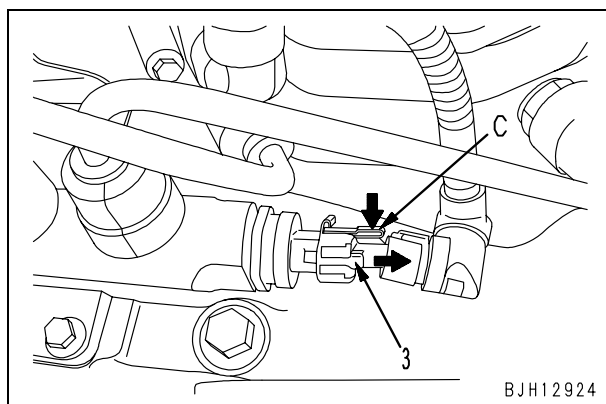
Disconnect connector (3) according to the following procedure.

- 1) While pressing lock (C), pull out connector (3) in the direction of the arrow.

- 114 engine

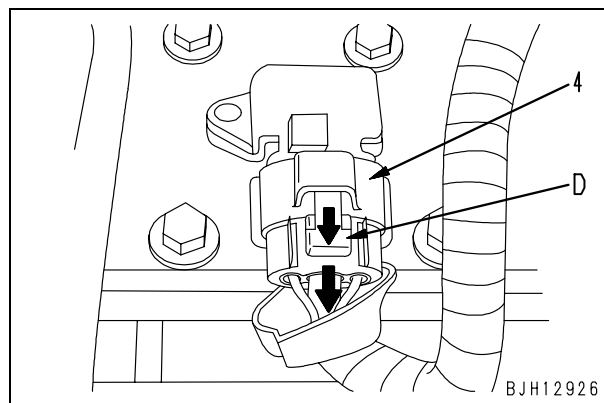


- 107 engine



- 107, 114 engines
Example)
Intake air pressure/temperature sensor in intake manifold
(**SUMITOMO-04**)

- 3) While pressing lock (D), pull out connector (4) in the direction of the arrow.



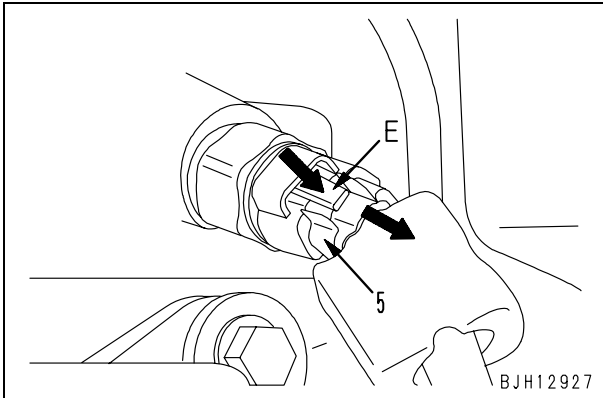
★ If the lock is on the underside, use flat-head screwdriver [1] since you cannot insert your fingers.

- 2) While pressing up lock (C) of the connector with flat-head screwdriver [1], pull out connector (3) in the direction of the arrow.

- 95, 125 – 170, 12V140 engines
- 4) While pressing lock (E) of the connector, pull out connector (5) in the direction of the arrow.

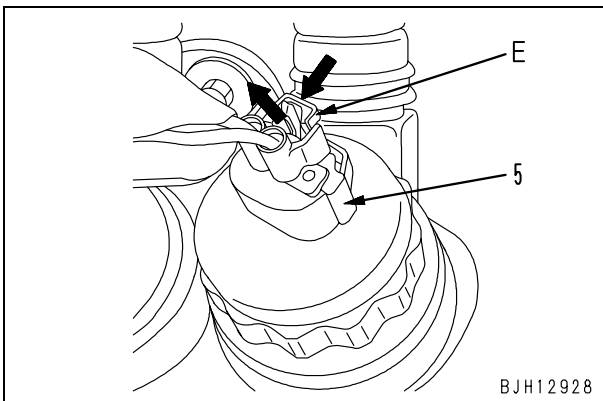
Example)

Fuel pressure sensor in common rail: PFUEL etc. (**AMP-3**)



Example)

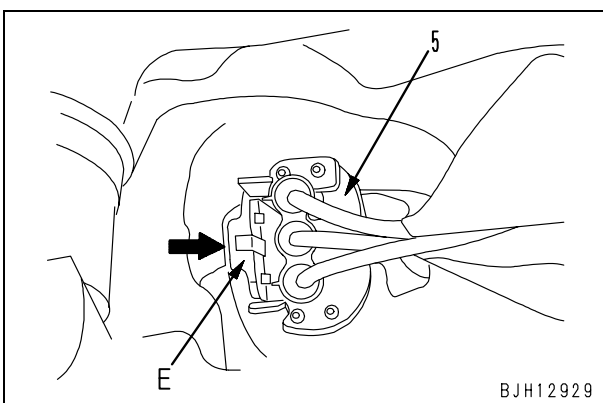
Injection pressure control valve of fuel supply pump: PCV (**SUMITOMO-2**)



Example)

Speed sensor of fuel supply pump: G (**SUMITOMO-3**)

- ★ Pull the connector straight up.



4. Turn-housing type (Round green connector)

- 140 engine

Example)

Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

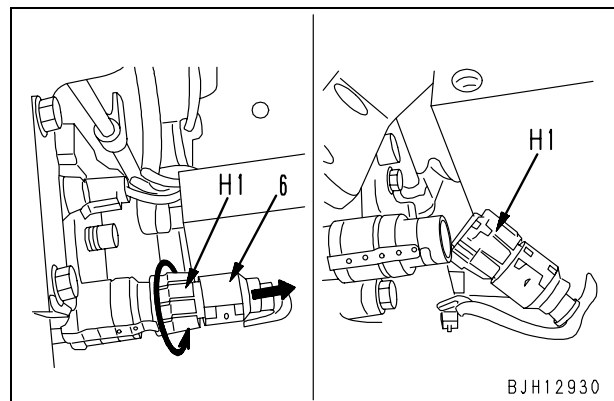
- 1) Disconnect connector (6) according to the following procedure.

- 1] Turn housing (H1) in the direction of the arrow.

★ When connector is unlocked, housing (H1) becomes heavy to turn.

- 2] Pull out housing (H1) in the direction of the arrow.

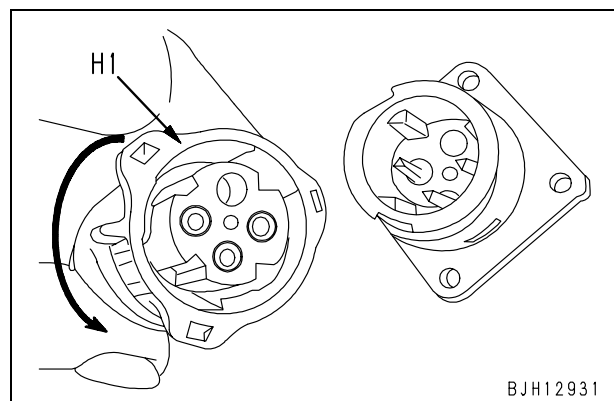
★ Housing (H1) is left on the wiring harness side.



- 2) Connect the connector according to the following procedure.

- 1] Insert the connector to the end, while setting its groove.

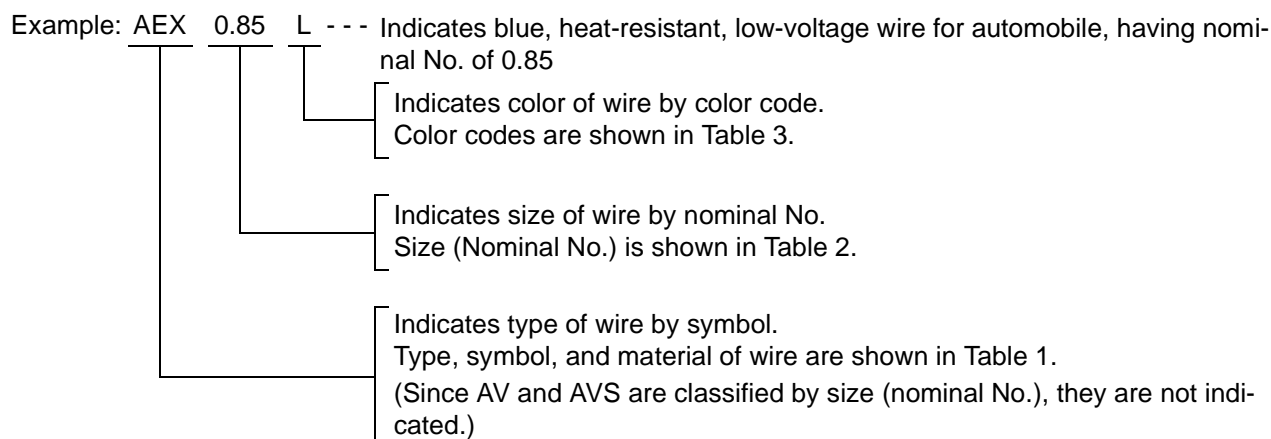
- 2] Turn housing (H1) in the direction of the arrow until it "clicks".



How to read electric wire code

- ★ The information about the wires unique to each machine model is described in Troubleshooting section, Relational information of troubleshooting.

In the electric circuit diagram, the material, thickness, and color of each electric wire are indicated by symbols. The electric wire code is helpful in understanding the electric circuit diagram.



1. Type, symbol, and material

AV and AVS are different in only thickness and outside diameter of the cover. AEX is similar to AV in thickness and outside diameter of AEX and different from AV and AVS in material of the cover.

(Table 1)

Type	Sym- bol	Material		Using temperature range (°C)	Example of use
Low-voltage wire for automobile	AV	Conduc- tor	Annealed copper for elec- tric appliance	-30 to +60	General wiring (Nominal No. 5 and above)
		Insulator	Soft polyvinyl chloride		
Thin-cover low-voltage wire for automobile	AVS	Conduc- tor	Annealed copper for elec- tric appliance	-30 to +60	General wiring (Nominal No. 3 and below)
		Insulator	Soft polyvinyl chloride		
Heat-resis- tant low-volt- age wire for automobile	AEX	Conduc- tor	Annealed copper for elec- tric appliance	-50 to +110	General wiring in extremely cold district, wiring at high-tem- perature place
		Insulator	Heat-resistant crosslinked polyethylene		

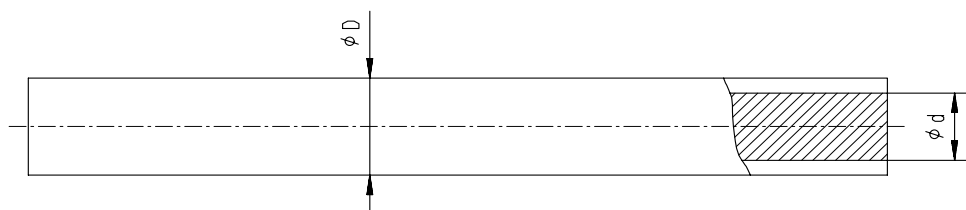
2. Dimensions

(Table 2)

Nominal No.		0.5f	(0.5)	0.75f	(0.85)	1.25f	(1.25)	2f	2	3f	3	5
Conductor	Number of strands/Diameter of strand	20/0.18	7/0.32	30/0.18	11/0.32	50/0.18	16/0.32	37/0.26	26/0.32	58/0.26	41/0.32	65/0.32
	Sectional area (mm ²)	0.51	0.56	0.76	0.88	1.27	1.29	1.96	2.09	3.08	3.30	5.23
	d (approx.)	1.0		1.2		1.5		1.9	1.9	2.3	2.4	3.0
Cover D	AVS	Standard	2.0	2.2	2.5	2.9	2.9	3.5	3.6	–		
	AV	Standard	–	–	–	–	–	–	–	–	–	4.6
	AEX	Standard	2.0	2.2	2.7	3.0	3.1	–	3.8	4.6		

Nominal No.		8	15	20	30	40	50	60	85	100
Conductor	Number of strands/Diameter of strand	50/0.45	84/0.45	41/0.80	70/0.80	85/0.80	108/0.80	127/0.80	169/0.80	217/0.80
	Sectional area (mm ²)	7.95	13.36	20.61	35.19	42.73	54.29	63.84	84.96	109.1
	d (approx.)	3.7	4.8	6.0	8.0	8.6	9.8	10.4	12.0	13.6
Cover D	AVS	Standard	–	–	–	–	–	–	–	–
	AV	Standard	5.5	7.0	8.2	10.8	11.4	13.0	13.6	16.0
	AEX	Standard	5.3	7.0	8.2	10.8	11.4	13.0	13.6	16.0

“f” of nominal No. denotes flexible”.



9JS02064

3. Color codes table

(Table 3)

Color Code	Color of wire	Color Code	Color of wire
B	Black	LgW	Light green & White
Br	Brown	LgY	Light green & Yellow
BrB	Brown & Black	LR	Blue & Red
BrR	Brown & Red	LW	Blue & White
BrW	Brown & White	LY	Blue & Yellow
BrY	Brown & Yellow	O	Orange
Ch	Charcoal	P	Pink
Dg	Dark green	R	Red
G	Green	RB	Red & Black
GB	Green & Black	RG	Red & Green
GL	Green & Blue	RL	Red & Blue
Gr	Gray	RW	Red & White
GR	Green & Red	RY	Red & Yellow
GW	Green & White	Sb	Sky Blue
GY	Green & Yellow	Y	Yellow
L	Blue	YB	Yellow & Black
LB	Blue & Black	YG	Yellow & Green
Lg	Light green	YL	Yellow & Blue
LgB	Light green & Black	YR	Yellow & Red
LgR	Light green & Red	YW	Yellow & White

Remarks: In a color code consisting of 2 colors, the first color is the color of the background and the second color is the color of the marking.

Example: "GW" means that the background is Green and marking is White.

4. Types of circuits and color codes

(Table 4)

Type of wire		AVS or AV						AEX	
Type of circuit	Charge	R	WG	–	–	–	–	R	–
	Ground	B	–	–	–	–	–	B	–
	Start	R	–	–	–	–	–	R	–
	Light	RW	RB	RY	RG	RL	–	D	–
	Instrument	Y	YR	YB	YG	YL	YW	Y	Gr
	Signal	G	GW	GR	GY	GB	GL	G	Br
	Others	L	LW	LR	LY	LB	–	L	–
		Br	BrW	BrR	BrY	BrB	–	–	–
		Lg	LgR	LgY	LgB	LgW	–	–	–
		O	–	–	–	–	–	–	–
		Gr	–	–	–	–	–	–	–
		P	–	–	–	–	–	–	–
		Sb	–	–	–	–	–	–	–
		Dg	–	–	–	–	–	–	–
		Ch	–	–	–	–	–	–	–

Precautions when carrying out operation

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number and thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ Precautions when handling piping during disassembly

Fit the following plugs into the piping after disconnecting it during disassembly operations.

1) Face seal type hoses and tubes

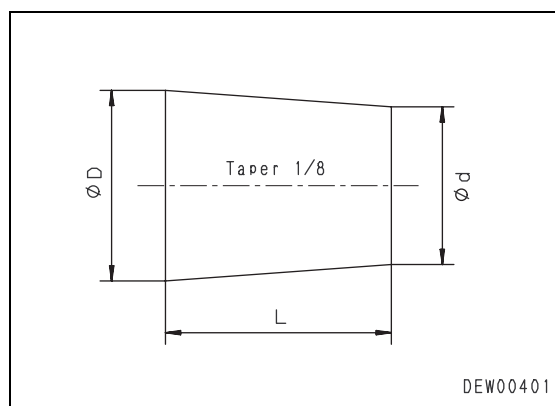
Nominal number	Plug (nut end)	Sleeve nut (elbow end)
02	07376-70210	02789-20210
03	07376-70315	02789-20315
04	07376-70422	02789-20422
05	07376-70522	02789-20522
06	07376-70628	02789-20628
10	07376-71034	07221-21034
12	07376-71234	07221-21234

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
 - Install the hoses without twisting or interference and fix them with intermediate clamps, if there are any.
 - Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
 - Bend the cotter pins and lock plates securely.
 - When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
 - When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
 - Clean all parts, and correct any damage, dents, burrs, or rust.
 - Coat rotating parts and sliding parts with engine oil.
 - When press fitting parts, coat the surface with anti-friction compound (LM-P).
 - After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
 - When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
 - When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
 - When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- ★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
- 1) Start the engine and run at low idle.
 - 2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
 - 3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
 - 4) After doing this, run the engine at normal speed.
- ★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

- 1) Refilling with coolant, oil and grease
 - If the coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
 - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
 - If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
 - ★ For details, see Testing and adjusting, “Bleeding air”.
 - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.
- 2) Checking cylinder head and manifolds for looseness

Check the cylinder head and intake and exhaust manifold for looseness.
If any part is loosened, retighten it.

 - For the tightening torque, see “Disassembly and assembly”.
- 3) Checking engine piping for damage and looseness

Intake and exhaust system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for air suction and exhaust gas leakage.
If any part is loosened or damaged, retighten or repair it.

Cooling system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for coolant leakage.
If any part is loosened or damaged, retighten or repair it.

Fuel system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for fuel leakage.
If any part is loosened or damaged, retighten or repair it.

- 4) Checking muffler and exhaust pipe for damage and looseness
 - 1] Visually check the muffler, exhaust pipe and their mounting parts for a crack and damage.
If any part is damaged, replace it.
 - 2] Check the mounting bolts and nuts of the muffler, exhaust pipe and their mounting parts for looseness.
If any bolt or nut is loosened, retighten it.
- 5) Checking muffler function
Check the muffler for abnormal sound and sound different from that of a new muffler.
If any abnormal sound is heard, repair the muffler, referring to "Troubleshooting" and "Disassembly and assembly".

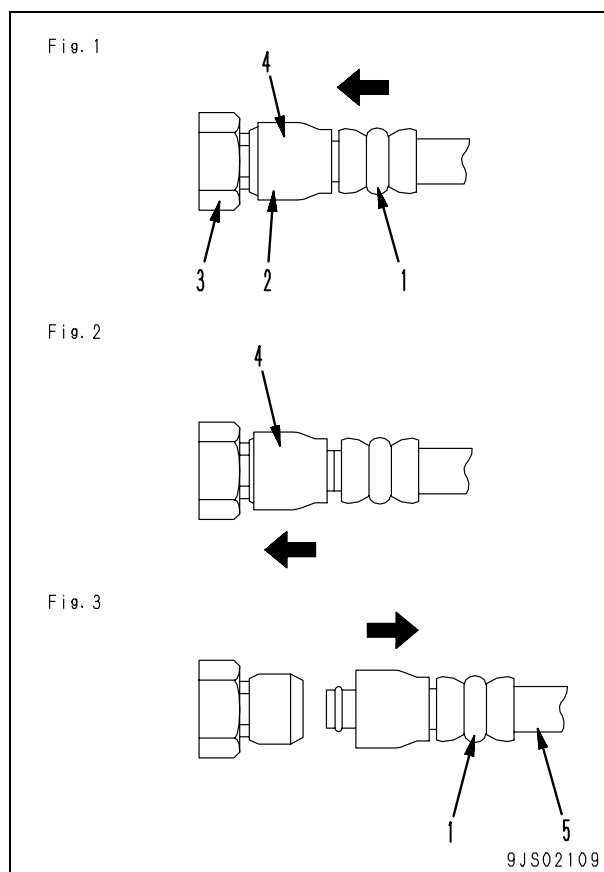
Method of disassembling and connecting push-pull type coupler

- ⚠ Before carrying out the following work, loosen the oil filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.
- ⚠ Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.

Type 1

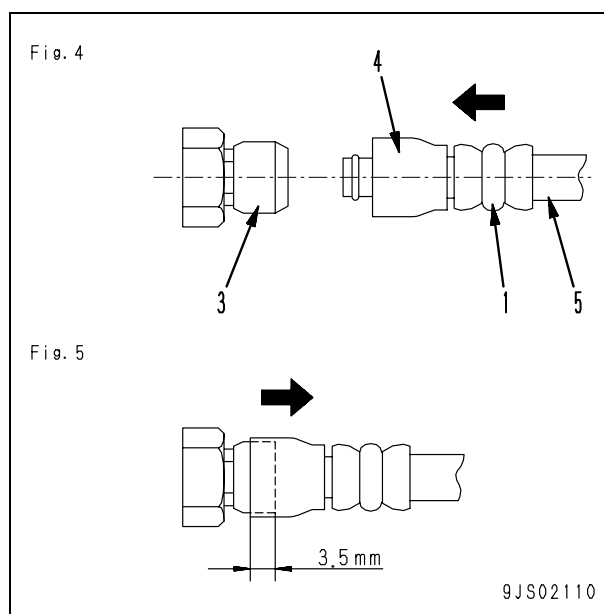
1. Disconnection

- 1) Hold adapter (1) and push hose joint (2) into mating adapter (3). (Fig. 1)
 - ★ The adapter can be pushed in about 3.5 mm.
 - ★ Do not hold rubber cap portion (4).
- 2) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against adapter (3) until it clicks. (Fig. 2)
- 3) Hold hose adapter (1) or hose (5) and pull it out. (Fig. 3)
 - ★ Since some hydraulic oil flows out, prepare an oil receiving container.



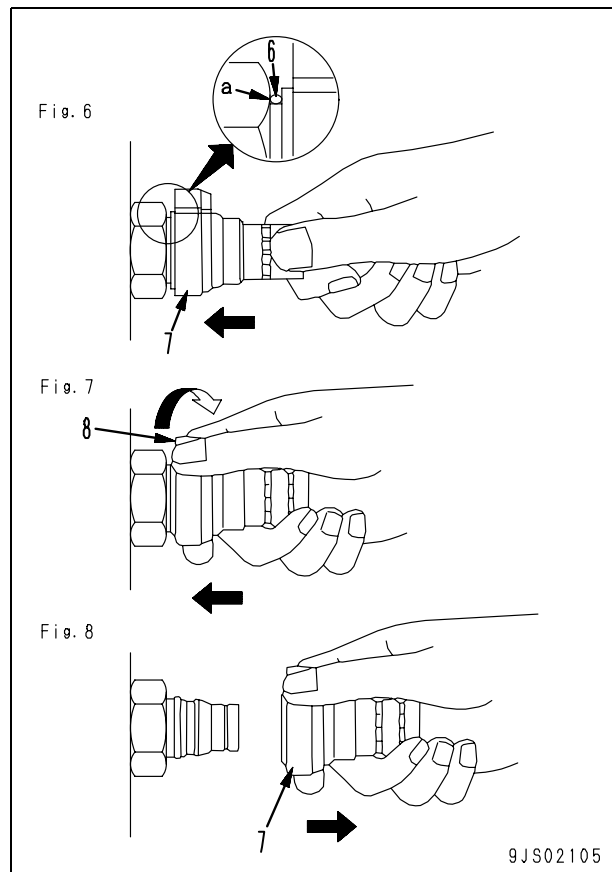
2. Connection

- 1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (Fig. 4)
 - ★ Do not hold rubber cap portion (4).
- 2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (Fig. 5)
 - ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.

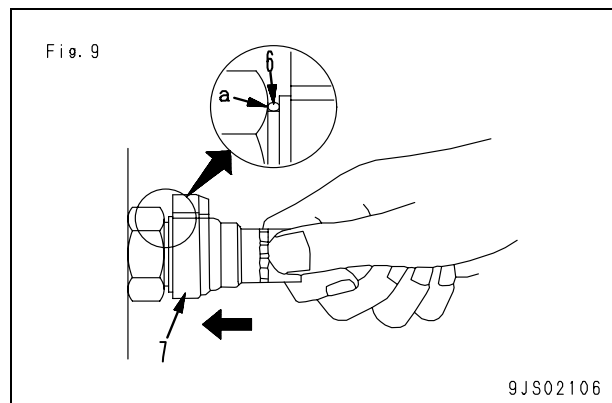


Type 2**1. Disconnection**

- 1) Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 6)
- 2) While holding the condition of Step 1), turn lever (8) to the right (clockwise). (Fig. 7)
- 3) While holding the condition of Steps 1) and 2), pull out whole body (7) to disconnect it. (Fig. 8)

**2. Connection**

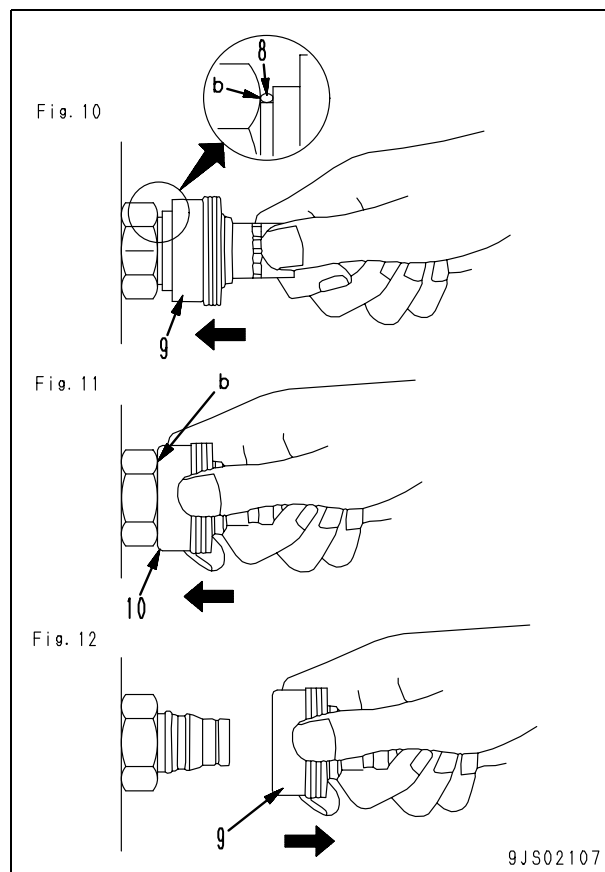
- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)



Type 3

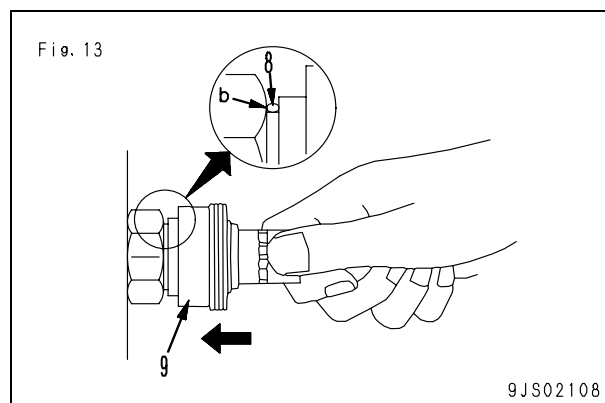
1. Disconnection

- 1) Hold the tightening portion and push body (9) straight until sliding prevention ring (8) contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 10)
- 2) While holding the condition of Step 1), push cover (10) straight until it contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 11)
- 3) While holding the condition of Steps 1) and 2), pull out whole body (9) to disconnect it. (Fig. 12)



2. Connection

- Hold the tightening portion and push body (9) straight until the sliding prevention ring contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 13)



Standard tightening torque table

1. Table of tightening torques for bolts and nuts

★ Unless there are special instructions, tighten metric nuts and bolts to the torque below.

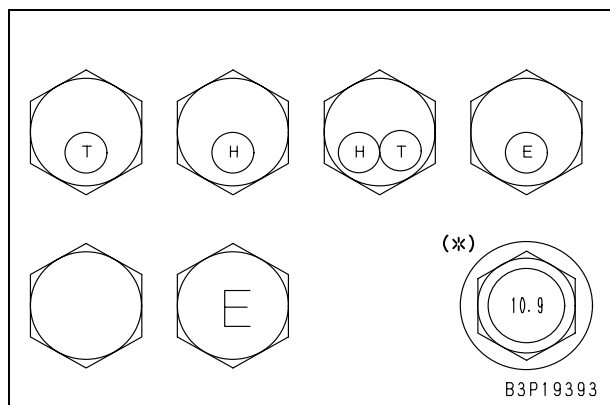
★ The following table applies to the bolts in Fig. A.

Thread diameter of bolt mm	Width across flats mm	Tightening torque	
		Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6.0 – 7.5
12	19	98 – 123	10.0 – 12.5
14	22	157 – 196	16 – 20
16	24	245 – 309	25 – 31.5
18	27	343 – 427	35 – 43.5
20	30	490 – 608	50 – 62
22	32	662 – 829	67.5 – 84.5
24	36	824 – 1,030	84 – 105
27	41	1,180 – 1,470	120 – 150
30	46	1,520 – 1,910	155 – 195
33	50	1,960 – 2,450	200 – 250
36	55	2,450 – 3,040	250 – 310
39	60	2,890 – 3,630	295 – 370

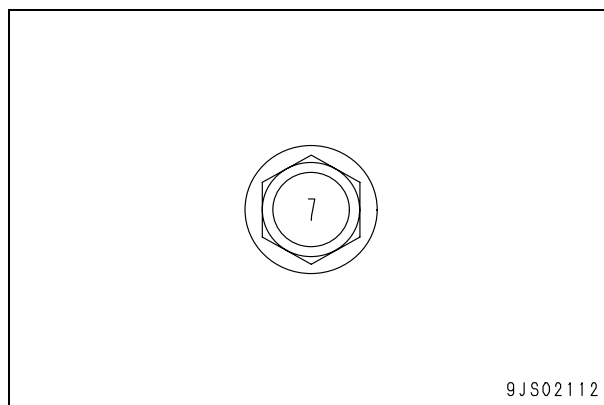
★ The following table applies to the bolts in Fig. B.

Thread diameter of bolt mm	Width across flats mm	Tightening torque	
		Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	12	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	17	74.5 – 90.2	7.6 – 9.2

★ Fig. A



★ Fig. B



Remarks: The widths across flats against the thread diameters of flanged bolts (marks with "※") in Fig. A are the ones indicated in the table for bolts shown in Fig. B.
(Values of tightening torques shown in the table for Fig. A are applied.)

2. Table of tightening torques for split flange bolts

★ Unless there are special instructions, tighten split flange bolts to the torque below.

Thread diameter of bolt	Width across flats	Tightening torque	
		Nm	kgm
10	14	59 – 74	6.0 – 7.5
12	17	98 – 123	10.0 – 12.5
16	22	235 – 285	23.5 – 29.5

3. Table of tightening torques for O-ring boss piping joints

★ Unless there are special instructions, tighten O-ring boss piping joints to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
02	14	Varies depending on type of connector.	35 – 63 { 3.5 – 6.5 }	44 { 4.5 }
03,04	20		84 – 132 { 8.5 – 13.5 }	103 { 10.5 }
05,06	24		128 – 186 { 13.0 – 19.0 }	157 { 16.0 }
10,12	33		363 – 480 { 37.0 – 49.0 }	422 { 43.0 }
14	42		746 – 1,010 { 76.0 – 103 }	883 { 90.0 }

4. Table of tightening torques for O-ring boss plugs

★ Unless there are special instructions, tighten O-ring boss plugs to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
08	8	14	5.88 – 8.82 { 0.6 – 0.9 }	7.35 { 0.75 }
10	10	17	9.81 – 12.74 { 1.0 – 1.3 }	11.27 { 1.15 }
12	12	19	14.7 – 19.6 { 1.5 – 2.0 }	17.64 { 1.8 }
14	14	22	19.6 – 24.5 { 2.0 – 2.5 }	22.54 { 2.3 }
16	16	24	24.5 – 34.3 { 2.5 – 3.5 }	29.4 { 3.0 }
18	18	27	34.3 – 44.1 { 3.5 – 4.5 }	39.2 { 4.0 }
20	20	30	44.1 – 53.9 { 4.5 – 5.5 }	49.0 { 5.0 }
24	24	32	58.8 – 78.4 { 6.0 – 8.0 }	68.6 { 7.0 }
30	30	32	93.1 – 122.5 { 9.5 – 12.5 }	107.8 { 11.0 }
33	33	–	107.8 – 147.0 { 11.0 – 15.0 }	127.4 { 13.0 }
36	36	36	127.4 – 176.4 { 13.0 – 18.0 }	151.9 { 15.5 }
42	42	–	181.3 – 240.1 { 18.5 – 24.5 }	210.7 { 21.5 }
52	52	–	274.4 – 367.5 { 28.0 – 37.5 }	323.4 { 33.0 }

5. Table of tightening torques for hoses (taper seal type and face seal type)

- ★ Unless there are special instructions, tighten the hoses (taper seal type and face seal type) to the torque below.
- ★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal No. of hose	Width across flats	Tightening torque Nm {kgm}		Taper seal Thread size (mm)	Face seal	
		Range	Target		Nominal No. – Number of threads, type of thread	Thread diameter (mm) (Reference)
02	19	34 – 54 { 3.5 – 5.5 }	44 { 4.5 }	–	9/16-18UN	14.3
		34 – 63 { 3.5 – 6.5 }		14	–	–
03	22	54 – 93 { 5.5 – 9.5 }	74 { 7.5 }	–	11/16-16UN	17.5
	24	59 – 98 { 6.0 – 10.0 }	78 { 8.0 }	18	–	–
04	27	84 – 132 { 8.5 – 13.5 }	103 { 10.5 }	22	13/16-16UN	20.6
05	32	128 – 186 { 13.0 – 19.0 }	157 { 16.0 }	24	1-14UNS	25.4
06	36	177 – 245 { 18.0 – 25.0 }	216 { 22.0 }	30	1-3/16-12UN	30.2
(10)	41	177 – 245 { 18.0 – 25.0 }	216 { 22.0 }	33	–	–
(12)	46	197 – 294 { 20.0 – 30.0 }	245 { 25.0 }	36	–	–
(14)	55	246 – 343 { 25.0 – 35.0 }	294 { 30.0 }	42	–	–

6. Table of tightening torques for face seal joints

- ★ Tighten the face seal joints (sleeve nut type) made of plated steel pipes for low pressure service to be used for engines etc. to the torque shown in the following table.
- ★ Apply the following torque to the face seal joint while their threaded parts are coated with engine oil (wetted).

Outer diameter of pipe (mm)	Width across flats (mm)	Tightening torque Nm {kgm}		Face seal	
		Range	Target	Nominal No. – Number of threads, type of thread	Thread diameter (mm) (Reference)
8	19	14 – 16 { 1.4 – 1.6 }	15 { 1.5 }	9/16-18UN	14.3
10	22	24 – 27 { 2.4 – 2.7 }	25.5 { 2.6 }	11/16-16UN	17.5
12	24 (27)	43 – 47 { 4.4 – 4.8 }	45 { 4.6 }	13/16-16UN	20.6
15 (16)	30 (32)	60 – 68 { 6.1 – 6.8 }	64 { 6.5 }	1-14UN	25.4
22 (20)	36	90 – 95 { 9.2 – 9.7 }	92.5 { 9.4 }	1-3/16-12UN	30.2

Reference: The face seal joints of the dimensions in () are also used, depending on the specification.

7. Table of tightening torques for 102, 107 and 114 engine series (Bolts and nuts)

- ★ Unless there are special instructions, tighten the metric bolts and nuts of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Bolts and nuts	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22
14	—	—

8. Table of tightening torques for 102, 107 and 114 engine series (Eye joints)

- ★ Unless there are special instructions, tighten the metric eye joints of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

9. Table of tightening torques for 102, 107 and 114 engine series (Taper screws)

- ★ Unless there are special instructions, tighten the taper screws (unit: inch) of the 102, 107 and 114 engine series to the torque below.

	Tightening torque			
Material	In cast iron or steel		In aluminum	
Thread size (inch)	Nm	kgm	Nm	kgm
1/16	15 ± 2	1.53 ± 0.20	5 ± 1	0.51 ± 0.10
1/8	20 ± 2	2.04 ± 0.20	15 ± 2	1.53 ± 0.20
1/4	25 ± 3	2.55 ± 0.31	20 ± 2	2.04 ± 0.20
3/8	35 ± 4	3.57 ± 0.41	25 ± 3	2.55 ± 0.31
1/2	55 ± 6	5.61 ± 0.61	35 ± 4	3.57 ± 0.41
3/4	75 ± 8	7.65 ± 0.82	45 ± 5	4.59 ± 0.51

Conversion table

Method of using the conversion table

The conversion table in this section is provided to enable simple conversion of figures. For details of the method of using the conversion table, see the example given below.

Example: Method of using the conversion table to convert from millimeters to inches

1. Convert 55 mm into inches.

- 1) Locate the number 50 in the vertical column at the left side, take this as (A), and then draw a horizontal line from (A).
- 2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
- 3) Take the point where the 2 lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.

2. Convert 550 mm into inches.

- 1) The number 550 does not appear in the table, so divide it by 10 (move the decimal point one place to the left) to convert it to 55 mm.
- 2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
- 3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

(B)

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
(A) 50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liters to U.S. Gallons

1 ℓ = 0.2642 U.S. Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liters to U.K. Gallons

1 ℓ = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft.lb

1 kgm = 7.233 ft.lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm² to lb/in²

$$1 \text{ kg/cm}^2 = 14.2233 \text{ lb/in}^2$$

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1,010	1,024	1,038	1,053	1,067	1,081	1,095	1,109	1,124
80	1,138	1,152	1,166	1,181	1,195	1,209	1,223	1,237	1,252	1,266
90	1,280	1,294	1,309	1,323	1,337	1,351	1,365	1,380	1,394	1,408
100	1,422	1,437	1,451	1,465	1,479	1,493	1,508	1,522	1,536	1,550
110	1,565	1,579	1,593	1,607	1,621	1,636	1,650	1,664	1,678	1,693
120	1,707	1,721	1,735	1,749	1,764	1,778	1,792	1,806	1,821	1,835
130	1,849	1,863	1,877	1,892	1,906	1,920	1,934	1,949	1,963	1,977
140	1,991	2,005	2,020	2,034	2,048	2,062	2,077	2,091	2,105	2,119
150	2,134	2,148	2,162	2,176	2,190	2,205	2,219	2,233	2,247	2,262
160	2,276	2,290	2,304	2,318	2,333	2,347	2,361	2,375	2,389	2,404
170	2,418	2,432	2,446	2,460	2,475	2,489	2,503	2,518	2,532	2,546
180	2,560	2,574	2,589	2,603	2,617	2,631	2,646	2,660	2,674	2,688
190	2,702	2,717	2,731	2,745	2,759	2,773	2,788	2,802	2,816	2,830
200	2,845	2,859	2,873	2,887	2,901	2,916	2,930	2,944	2,958	2,973
210	2,987	3,001	3,015	3,030	3,044	3,058	3,072	3,086	3,101	3,115
220	3,129	3,143	3,158	3,172	3,186	3,200	3,214	3,229	3,243	3,257
230	3,271	3,286	3,300	3,314	3,328	3,343	3,357	3,371	3,385	3,399
240	3,414	3,428	3,442	3,456	3,470	3,485	3,499	3,513	3,527	3,542

Temperature

Fahrenheit-Centigrade conversion: A simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center (boldface column) of figures. These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

When convert from Fahrenheit to Centigrade degrees, consider the center column to be a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

When convert from Centigrade to Fahrenheit degrees, consider the center column to be a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	177.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04066-02

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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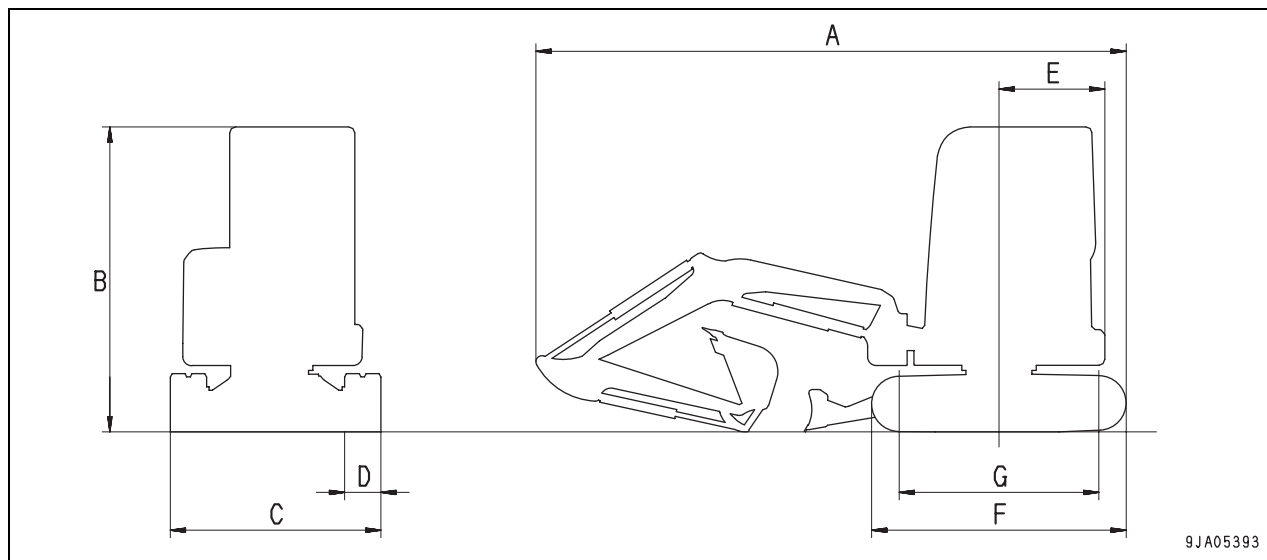
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

01 Specification

100 Specification and technical data

Specification dimension drawing	2
Working range drawing	3
Specifications	4
Weight table	14
Table of fuel, coolant and lubricants	18

Specification dimension drawing

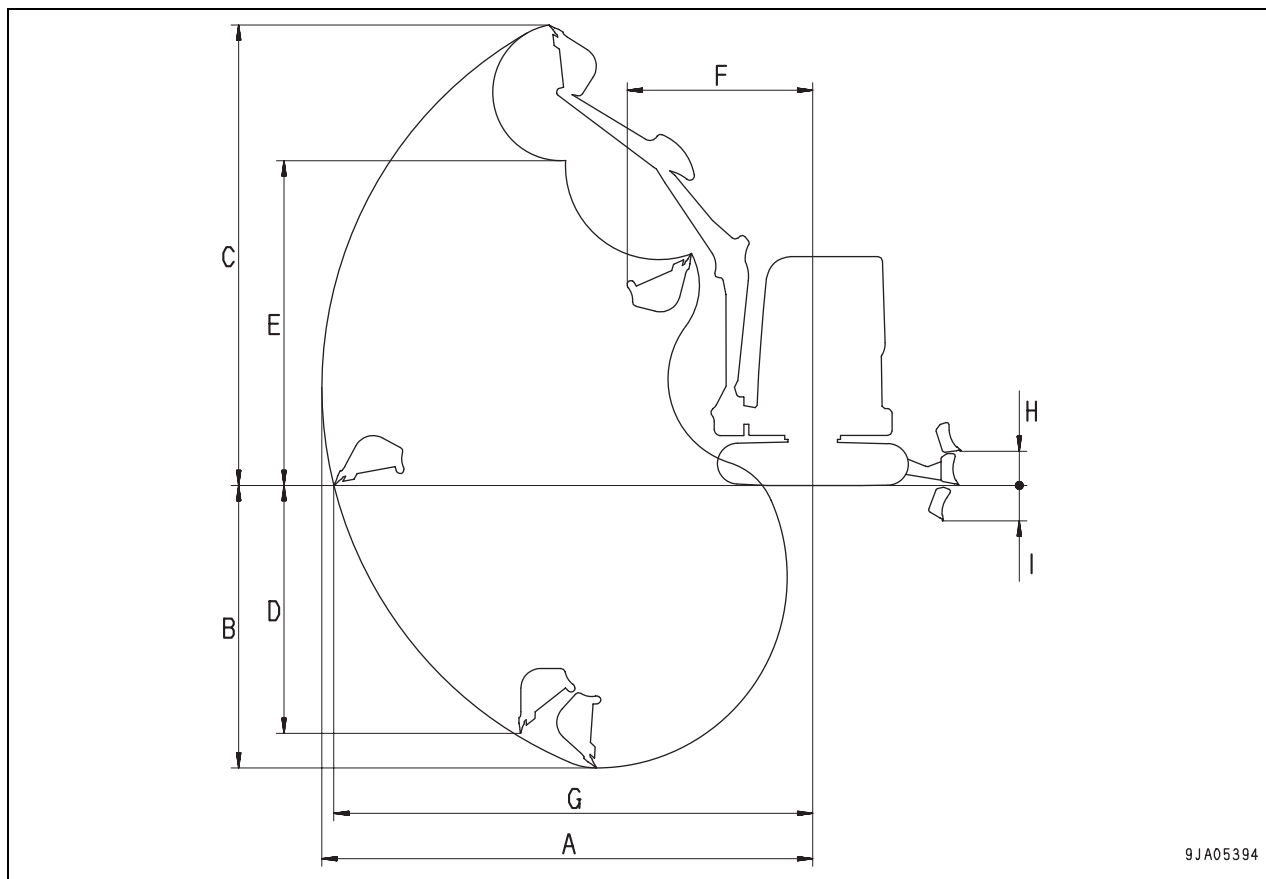


	Item		Unit	PC27MR-3	PC30MR-3	PC35MR-3
	Operating weight	Canopy specification	kg	<2,930>	3,160	3,575 <3,595>
		Cab specification		<3,080>	3,310	3,725 <3,745>
	Bucket capacity		m³	0.08	0.09	0.11
	Engine model		—	Komatsu 3D82AE-6 Diesel engine	Komatsu 3D88E-6 Diesel engine	Komatsu 3D88E-6 Diesel engine
	Rated engine output		kW{HP}/rpm	19.2 {26} / 2,600	21.4 {29} / 2,400	21.4 {29} / 2,400
A	Overall length		mm	4,240 <4,275>	4,560	4,825 <4,905>
B	Overall height		mm	2,520	2,520	2,520
C	Overall width		mm	1,550	1,550	1,740
D	Shoe width		mm	300	300	300
E	Tail swing radius	Canopy specification	mm	855	855	950
		Cab specification		885	885	950
F	Overall length of track		mm	1,905	2,105	2,105
G	Distance between tumbler centers		mm	1,485	1,650	1,650
	Minimum ground clearance		mm	320	305	290
	Travel speed (Low / High)		km/h	2.6 / 4.8	2.5 / 4.6	2.8 / 4.8
	Continuous swing speed		rpm	9.2	9.3	9.0

★ Values in < > are for the long arm specifications.

★ Operating weight of machine with full tank of fuel and a 75 kg operator (ISO 6016).

Working range drawing



	Working range (mm)	PC27MR-3	PC30MR-3	PC35MR-3
A	Max. digging radius	4,650 {4,930}	5,050	5,300 {5,640}
B	Max. digging depth	2,550 {2,840}	2,760	3,110 {3,455}
C	Max. digging height	4,480 {4,840}	4,840	5,000 {5,270}
D	Max. vertical wall depth	2,080 {2,370}	2,400	2,690 {3,120}
E	Max. dumping height	3,190 {3,390}	3,350	3,530 {3,790}
F	Swing radius of work equipment <Values in () are boom swing radii>	1,980 {2,030} (1,660) ({1,700})	2,055 (1,560)	2,030 {2,140} (1,600) ({1,710})
G	Max. reach at ground level	4,450 {4,840}	4,910	5,170 {5,520}
H	Blade lifting height	360	360	360
I	Blade lowering depth	315	310	390

★ Values in { } are for the long arm specifications.

Specifications

Machine model				PC27MR-3	
				Canopy specification	Cab specification
Serial number				20002 and up	
Bucket capacity		m ³		0.08	0.08
Operating weight		kg		<2,930> [3,035]	<3,080> [3,185]
Performance	Working ranges	Max. digging depth	mm	2,550 <2,840>	2,550 <2,840>
		Max. vertical wall depth	mm	2,080 <2,370>	2,080 <2,370>
		Max. digging reach	mm	4,650 <4,930>	4,650 <4,930>
		Max. reach at ground level	mm	4,550 <4,840>	4,550 <4,840>
		Max. digging height	mm	4,480 <4,840>	4,480 <4,840>
		Max. dumping height	mm	3,190 <3,390>	3,190 <3,390>
		Bucket offset	mm	580 (L.H.), 845 (R.H.)	580 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360	360
		Max. blade lowering depth	mm	315	315
	Max. digging force (bucket)		kN {kg}	21.9 {2,230}	21.9 {2,230}
	Continuous swing speed		rpm	9.2	9.2
	Swing max. slope angle		deg.	19.0	19.0
	Travel speed		km/h	2.6 (Lo) / 4.8 (Hi)	2.6 (Lo) / 4.8 (Hi)
	Gradeability		deg.	30	30
	Ground pressure		kPa {kg/cm ² }	28.8 {0.29} [29.8 {0.30}]	30.3 {0.31} [31.3 {0.32}]
Dimensions	Overall length (for transport)		mm	4,240 <4,275>	4,240 <4,275>
	Overall width		mm	1,550	1,550
	Overall height (for transport)		mm	2,520	2,520
	Ground clearance of counterweight		mm	545	545
	Min. ground clearance		mm	320	320
	Tail swing radius		mm	855	885
	Min. swing radius of work equipment (at boom swing)		mm	1,980 (1,660)	1,980 (1,660)
	Height of work equipment at min. swing radius		mm	3,445	3,445
	Overall width of crawler		mm	1,550	1,550
	Overall length of crawler		mm	1,950	1,950
	Distance between tumbler centers		mm	1,485	1,485
	Track gauge		mm	1,250	1,250
	Machine cab height		mm	1,360	1,360
	Blade width x height		mm	1,550 x 325	1,550 x 325

- ★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
- ★ Values in < > are for the long arm specifications.
- ★ Values in [] are for steel shoe specification.
- ★ Operating weight of machine with full tank of fuel and a 75 kg operator (ISO 6016).

Machine model			PC27MR-3	
			Canopy specification	Cab specification
Serial number			20002 and up	
Engine	Model		3D82AE-6	
	Type		4-cycle, water cooled, in-line direct injection type	
	No. of cylinders – bore x stroke		3 – 82 × 84	
	Piston displacement		1.330 {1,330}	
	Performance	Flywheel horsepower	19.2 / 2,600 {26 / 2,600}	
		Maximum torque	82.9 / 1,500 {8.5 / 1,500}	
		High idle speed	2,780	
		Low idle speed	1,325	
	Starting motor		12 V, 2.3 kW	
	Alternator		12 V, 40 A	
	Battery (*1)		12 V, 58 Ah × 1 (90D26L)	
Undercarriage	Radiator		CF34-1	
	• Core type			
	Carrier roller		1 on each side	
	Track roller		4 on each side	
	Track shoe (Rubber shoe)		Unit-type rubber crawler	
Hydraulic system	Track shoe (Steel shoe)		Assembly-type double grouser: 40 each side	
	Hydraulic pump	Type x no.	Variable displacement piston type × 1, gear type × 1	
		Theoretical capacity	30 + 8.5	
		Set pressure		
		For travel, work equipment	24.5 {250}	
		For swing	17.2 {175}	
		For blade	21.1 {215}	
	Control valve	Type x no.	9-spool type × 1	
		Control method	Hydraulic assist type	
	Hydraulic motor	Travel motor	Variable-displacement piston motor (with counter-balance valve, parking brake) × 2	
		Swing motor	Fixed-displacement piston motor (with brake valve, swing shaft brake) × 1	
	Hydraulic tank		Box-shaped, open type	
	Hydraulic oil filter		Tank return side	
	Hydraulic oil cooler		Air cooled (Drawn-CUP)	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model				PC27MR-3	
				Canopy specification	Cab specification
Serial number				20002 and up	
Hydraulic system	Work equipment cylinder	Boom cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	75	
			Outside diameter of piston rod	45	
			Stroke	552.5	
			Max. distance between pins	1,450	
			Min. distance between pins	897.5	
		Arm cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	60	
			Outside diameter of piston rod	40	
			Stroke	544	
			Max. distance between pins	1,350	
			Min. distance between pins	806	
		Bucket cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	55	
			Outside diameter of piston rod	35	
			Stroke	460	
			Max. distance between pins	1,190	
			Min. distance between pins	730	
		Boom swing cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	75	
			Outside diameter of piston rod	40	
			Stroke	500	
			Max. distance between pins	1,272	
			Min. distance between pins	772	
		Blade cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	85	
			Outside diameter of piston rod	45	
			Stroke	135	
			Max. distance between pins	561.5	
			Min. distance between pins	426.5	

Machine model				PC30MR-3	
				Canopy specification	Cab specification
Serial number				30001 and up	
Bucket capacity		m ³		0.09	0.09
Operating weight		kg		3,160 [3,270]	3,310 [3,420]
Performance	Working ranges	Max. digging depth	mm	2,760	2,760
		Max. vertical wall depth	mm	2,400	2,400
		Max. digging reach	mm	5,050	5,050
		Max. reach at ground level	mm	4,910	4,910
		Max. digging height	mm	4,840	4,840
		Max. dumping height	mm	3,350	3,350
		Bucket offset	mm	580 (L.H.), 845 (R.H.)	580 (L.H.), 845 (R.H.)
		Max. blade lifting height	mm	360	360
		Max. blade lowering depth	mm	310	310
		Max. digging force (bucket)	kN {kg}	29.5 {3,000}	29.5 {3,000}
		Continuous swing speed	rpm	9.3	9.3
		Swing max. slope angle	deg.	19.0	19.0
		Travel speed	km/h	2.5 (Lo) / 4.6 (Hi)	2.5 (Lo) / 4.6 (Hi)
		Gradeability	deg.	30	30
		Ground pressure	kPa {kg/cm ² }	29.1 {0.30} [30.1 {0.31}]	30.5 {0.31} [31.5 {0.32}]
	Dimensions	Overall length (for transport)	mm	4,560	4,560
		Overall width	mm	1,550	1,550
		Overall height (for transport)	mm	2,520	2,520
		Ground clearance of counterweight	mm	545	545
		Min. ground clearance	mm	305	305
		Tail swing radius	mm	855	885
		Min. swing radius of work equipment (at boom swing)	mm	2,055 (1,560)	2,055 (1,560)
		Height of work equipment at min. swing radius	mm	3,935	3,935
		Overall width of crawler	mm	1,550	1,550
		Overall length of crawler	mm	2,105	2,105
		Distance between tumbler centers	mm	1,650	1,650
		Track gauge	mm	1,250	1,250
		Machine cab height	mm	1,360	1,360
		Blade width x height	mm	1,550 x 355	1,550 x 355

- ★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
- ★ Values in [] are for the steel shoe specification.
- ★ Operating weight of machine with full tank of fuel and a 75 kg operator (ISO 6016).

Machine model			PC30MR-3	
			Canopy specification	Cab specification
Serial number			30001 and up	
Engine	Model		3D88E-6	
	Type		4-cycle, water cooled, in-line direct injection type	
	No. of cylinders – bore x stroke		3 – 88 × 90	
	Piston displacement		1.642 {1,642}	
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	
		Maximum torque	Nm/rpm {kgm/rpm}	
		High idle speed	rpm	
		Low idle speed	rpm	
	Starting motor		12 V, 2.3 kW	
	Alternator		12 V, 40 A	
	Battery (*1)		12 V, 58 Ah × 1 (90D26L)	
	Radiator • Core type		CF34-1	
Undercarriage	Carrier roller		1 on each side	
	Track roller		4 on each side	
	Track shoe (Rubber shoe)		Unit-type rubber crawler	
	Track shoe (Steel shoe)		Assembly-type double grouser: 44 each side	
Hydraulic system	Hydraulic pump	Type x no.	Variable displacement piston type × 1, gear type × 1	
		Theoretical capacity	cm ³ /rev	
		Set pressure		
		For travel, work equipment	MPa {kg/cm ² }	
		For swing	MPa {kg/cm ² }	
		For blade	MPa {kg/cm ² }	
	Control valve	Type x no.	9-spool type × 1	
		Control method	Hydraulic assist type	
	Hydraulic motor	Travel motor	Variable-displacement piston motor (with counter-balance valve, parking brake) × 2	
		Swing motor	Fixed-displacement piston motor (with brake valve, swing shaft brake) × 1	
	Hydraulic tank		Box-shaped, open type	
	Hydraulic oil filter		Tank return side	
	Hydraulic oil cooler		Air cooled (Drawn-CUP)	

Machine model				PC30MR-3	
				Canopy specification	Cab specification
Serial number				30001 and up	
Hydraulic system	Work equipment cylinder	Boom cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	80
			Outside diameter of piston rod	mm	45
			Stroke	mm	550
			Max. distance between pins	mm	1,450
			Min. distance between pins	mm	900
		Arm cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	75
			Outside diameter of piston rod	mm	45
			Stroke	mm	595
			Max. distance between pins	mm	1,275
			Min. distance between pins	mm	780
		Bucket cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	65
			Outside diameter of piston rod	mm	40
			Stroke	mm	490
			Max. distance between pins	mm	1,270
			Min. distance between pins	mm	780
		Boom swing cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	80
			Outside diameter of piston rod	mm	40
			Stroke	mm	500
			Max. distance between pins	mm	1,272
			Min. distance between pins	mm	772
		Blade cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	85
			Outside diameter of piston rod	mm	45
			Stroke	mm	135
			Max. distance between pins	mm	561.5
			Min. distance between pins	mm	426.5

Machine model				PC35MR-3		
				Canopy specification	Cab specification	
Serial number				15001 and up		
Bucket capacity			m³	0.11	0.11	
Operating weight			kg	3,575 <3,595> [3,675 <3,695>]	3,725 <3,745> [3,825 <3,845>]	
Performance	Working ranges	Max. digging depth	mm	3,110 <3,455>	3,110 <3,455>	
		Max. vertical wall depth	mm	2,690 <3,120>	2,690 <3,120>	
		Max. digging reach	mm	5,300 <5,640>	5,300 <5,640>	
		Max. reach at ground level	mm	5,170 <5,520>	5,170 <5,520>	
		Max. digging height	mm	5,000 <5,270>	5,000 <5,270>	
		Max. dumping height	mm	3,530 <3,790>	3,530 <3,790>	
		Bucket offset	mm	580 (L.H.), 770 (R.H.)	580 (L.H.), 770 (R.H.)	
		Max. blade lifting height	mm	360	360	
		Max. blade lowering depth	mm	390	390	
	Max. digging force (bucket)		kN {kg}	29.9 {3,050}	29.9 {3,050}	
	Continuous swing speed		rpm	9.0	9.0	
	Swing max. slope angle		deg.	19.0	19.0	
	Travel speed		km/h	2.8 (Lo) / 4.8 (Hi)	2.8 (Lo) / 4.8 (Hi)	
	Gradeability		deg.	30	30	
	Ground pressure		kPa {kg/cm²}	<34.8 {0.36}> [35.8 {0.36}]	<36.3 {0.37}> [37.2 {0.38}]	
	Dimensions	Overall length (for transport)		mm	4,825 <4,905>	4,825 <4,905>
		Overall width		mm	1,740	1,740
		Overall height (for transport)		mm	2,520 [2,515]	2,520 [2,515]
Ground clearance of conterweight		mm	545 [540]	545 [540]		
Min. ground clearance		mm	290 [285]	290 [285]		
Tail swing radius		mm	870 <950>	950 <950>		
Min. swing radius of work equipment (at boom swing)		mm	2,030 (1,600)	2,030 (1,600)		
Height of work equipment at min. swing radius		mm	3,935	3,935		
Overall width of crawler		mm	1,740	1,740		
Overall length of crawler		mm	2,105	2,105		
Distance between tumbler centers		mm	1,650	1,650		
Track gauge		mm	1,440	1,440		
Machine cab height		mm	1,360	1,360		
Blade width x height		mm	1,740 × 355	1,740 × 355		

- ★ Values are common to all specifications, unless otherwise specified. (The values of the rubber shoe specification are shown.)
- ★ Values in < > are for the long arm specifications.
- ★ Values in [] are for the steel shoe specification.
- ★ Operating weight of machine with full tank of fuel and a 75 kg operator (ISO 6016).

Machine model			PC35MR-3	
			Canopy specification	Cab specification
Serial number			15001 and up	
Engine	Model		3D88E-6	
	Type		4-cycle, water cooled, in-line direct injection type	
	No. of cylinders – bore x stroke		3 – 88 × 90	
	Piston displacement		1.642 {1,642}	
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	21.4 / 2,400 {29 / 2,400}
		Maximum torque	Nm/rpm {kgm/rpm}	102.9 / 1,440 {10.5 / 1,440 }
		High idle speed	rpm	2,590
		Low idle speed	rpm	1,250
	Starting motor		12 V, 2.3 kW	
	Alternator		12 V, 40 A	
	Battery (*1)		12 V, 58 Ah × 1 (90D26L)	
Undercarriage	Radiator		CF34-1	
	• Core type			
	Carrier roller		1 on each side	
	Track roller		4 on each side	
	Track shoe (Rubber shoe)		Unit-type rubber crawler	
Hydraulic system	Track shoe (Steel shoe)		Assembly-type double grouser: 44 each side	
	Hydraulic pump	Type x no.	Variable displacement piston type × 1, gear type × 2	
		Theoretical capacity	15.5 × 2 + 8.5 + 4.5	
		Set pressure		
		For travel, work equipment	MPa {kg/cm ² }	26.0 {265}
		For swing	MPa {kg/cm ² }	19.1 {195}
		For blade	MPa {kg/cm ² }	21.6 {220}
	Control valve	Type x no.	9-spool type × 1	
		Control method	Hydraulic assist type	
	Hydraulic motor	Travel motor	Variable-displacement piston motor (with counter-balance valve, parking brake) × 2	
		Swing motor	Fixed-displacement piston motor (with brake valve, swing shaft brake) × 1	
	Hydraulic tank		Box-shaped, open type	
	Hydraulic oil filter		Tank return side	
	Hydraulic oil cooler		Air cooled (Drawn-CUP)	

*1: The battery capacity (Ah) is based on 5-hour rate.

Machine model				PC35MR-3	
				Canopy specification	Cab specification
Serial number				15001 and up	
Hydraulic system	Work equipment cylinder	Boom cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	80
			Outside diameter of piston rod	mm	45
			Stroke	mm	585
			Max. distance between pins	mm	1,530
			Min. distance between pins	mm	945
		Arm cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	75
			Outside diameter of piston rod	mm	45
			Stroke	mm	595
			Max. distance between pins	mm	1,510
			Min. distance between pins	mm	915
		Bucket cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	65
			Outside diameter of piston rod	mm	40
			Stroke	mm	490
			Max. distance between pins	mm	1,270
			Min. distance between pins	mm	780
		Boom swing cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	95
			Outside diameter of piston rod	mm	50
			Stroke	mm	482
			Max. distance between pins	mm	1,283
			Min. distance between pins	mm	801
		Blade cylinder	Cylinder type	Double acting piston	
			Inside diameter of cylinder	mm	95
			Outside diameter of piston rod	mm	45
			Stroke	mm	140
			Max. distance between pins	mm	610
			Min. distance between pins	mm	470

Weight table

⚠ This weight table is a guide for use when transporting or handling components.

Unit: kg

Machine model	PC27MR-3	
	Canopy specification	Cab specification
Serial number	20002 and up	
Engine assembly (without oil, coolant)	194	194
• Engine	146	146
• Engine mount	7	7
• PTO	10	10
• Hydraulic pump	31	31
Cooling assembly (excluding coolant and oil)	18	18
Battery	19	19
Revolving frame	337	337
Floor frame	154	154
Canopy assembly	87	—
Handrail	6	—
Operator's cab (with floor frame)	—	395
Operator's seat	12	12
Fuel tank (without fuel)	5	5
Hydraulic tank (without hydraulic oil)	29	29
Control valve	35	35
Counterweight	263	263
X-weight (Additional counterweight)	190	190
Swing motor (with brake valve)	14	14
Swing machinery	19	19
Track frame assembly (without track shoe)	559	559
• Track frame	285	285
• Idler assembly	26 × 2	26 × 2
• Recoil spring assembly	14 × 2	14 × 2
• Carrier roller assembly	4 × 2	4 × 2
• Track roller assembly	6 × 8	6 × 8
• Travel motor (with reduction gear)	36 × 2	36 × 2
• Sprocket	10 × 2	10 × 2
• Swing circle	37	37
• Center swivel joint	9	9

Unit: kg

PC30MR-3		PC35MR-3	
Canopy specification	Cab specification	Canopy specification	Cab specification
30001 and up		15001 and up	
203	203	203	203
155	155	155	155
7	7	7	7
10	10	10	10
29	29	31	31
18	18	18	18
19	19	19	19
337	337	358	358
154	154	154	154
87	—	87	—
6	—	6	—
—	395	—	395
12	12	12	12
5	5	5	5
29	29	29	29
35	35	42	42
262	262	455	455
190	190	190	190
14	14	14	14
19	19	19	19
655	655	695	695
365	365	395	395
26 × 2	26 × 2	26 × 2	26 × 2
14 × 2	14 × 2	14 × 2	14 × 2
4 × 2	4 × 2	4 × 2	4 × 2
6 × 8	6 × 8	6 × 8	6 × 8
36 × 2	36 × 2	36 × 2	36 × 2
10 × 2	10 × 2	10 × 2	10 × 2
37	37	37	37
15	15	15	15

Unit: kg

Machine model	PC27MR-3	
	Canopy specification	Cab specification
Serial number	20002 and up	
Track shoe assembly		
• Rubber shoe (300 mm)	113 × 2	113 × 2
• Double grouser shoe (300 mm)	156 × 2	156 × 2
• Road liner (300 mm)	175 × 2	175 × 2
Boom swing bracket assembly	60	60
Boom assembly	95	95
Arm assembly	44	44
Bucket link assembly	16	16
Bucket assembly (with side cutter)	55	55
Blade assembly	141	141
Boom cylinder assembly	24	24
Arm cylinder assembly	18	18
Bucket cylinder assembly	13	13
Boom swing cylinder assembly	19	19
Blade cylinder assembly	15	15

Unit: kg

PC30MR-3		PC35MR-3	
Canopy specification	Cab specification	Canopy specification	Cab specification
30001 and up		15001 and up	
122 × 2	122 × 2	126 × 2	126 × 2
170 × 2	170 × 2	170 × 2	170 × 2
193 × 2	193 × 2	193 × 2	193 × 2
60	60	69	69
99	99	117	117
51	51	60	60
18	18	18	18
63	63	76	76
156	156	167	167
26	26	29	29
23	23	26	26
18	18	18	18
21	21	33	33
15	15	20	20

Table of fuel, coolant and lubricants

★ For details of notes (Notes 1 and 2 ...) in the table, see "Operation and Maintenance Manual".

Reservoir	Fluid Type	Ambient Temperature, degrees Celsius										Recommended Komatsu Fluids
		-22	-4	14	32	50	68	86	104	122°F		
		-30	-20	-10	0	10	20	30	40	50°C		
Engine oil pan	Engine oil											Komatsu EO10W30DH
												Komatsu EO15W40DH
												Komatsu EO30DH
Final drive case	Powertrain oil (Note.1)											TO30
Hydraulic system	Powertrain oil											TO10
	Hydraulic oil											HO46-HM
Grease fitting	Hyper grease (Note.2)											G2-T, G2-TE
	Lithium EP grease											G2-LI
Cooling system	Supercoolant AF-NAC (Note.3)											AF-NAC
Fuel tank	Diesel fuel											ASTM Grade No.1-D S15 ASTM Grade No.1-D S500
												ASTM Grade No.2-D S15 ASTM Grade No.2-D S500

Unit: ℓ

Reservoir	PC27MR-3		PC30MR-3		PC35MR-3	
	Specified capacity	Refill capacity	Specified capacity	Refill capacity	Specified capacity	Refill capacity
Engine oil pan	5.7	5.2	7.7	7.2	7.7	7.2
Final drive case (each)	0.6	0.6	0.6	0.6	0.6	0.6
Hydraulic system	34	14	34	14	39	14
Fuel tank	44	—	44	—	44	—
Cooling system	3.3	—	3.3	—	3.3	—

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

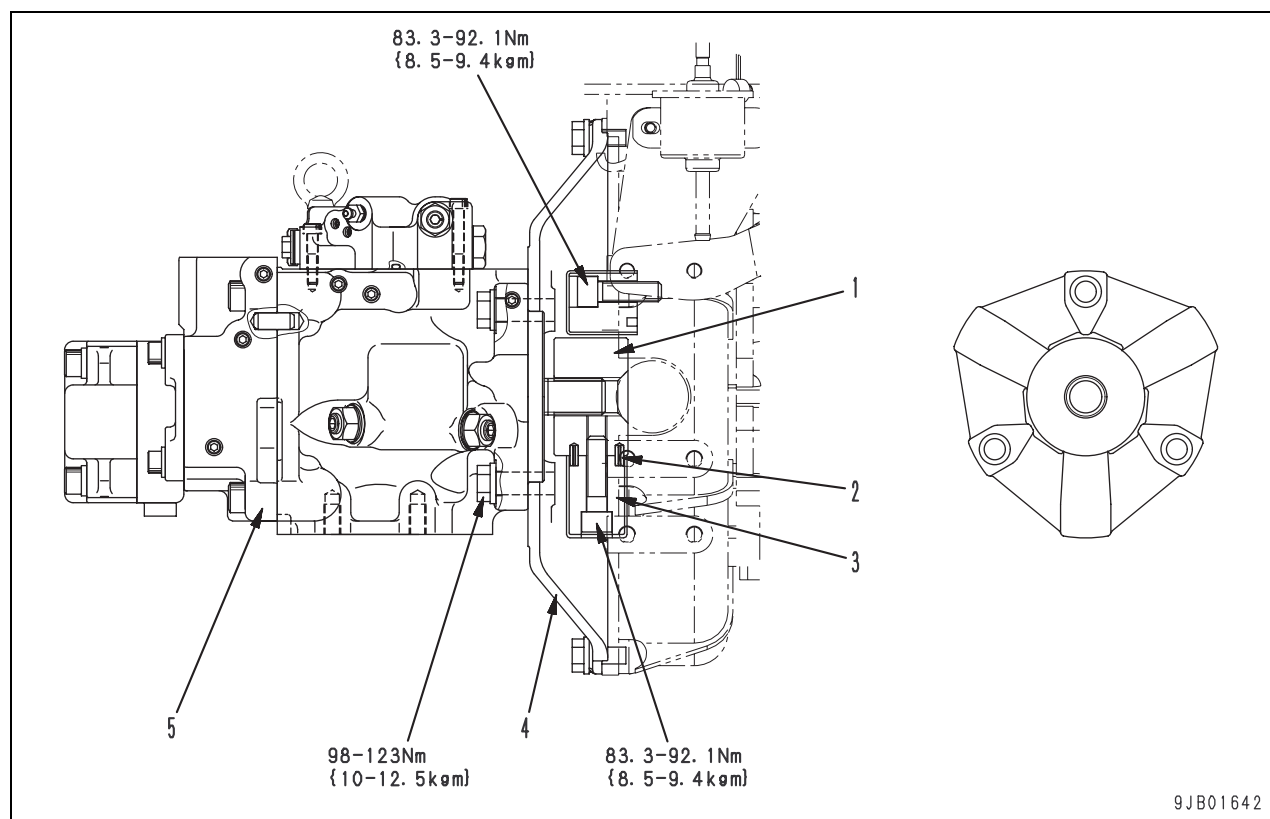
PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

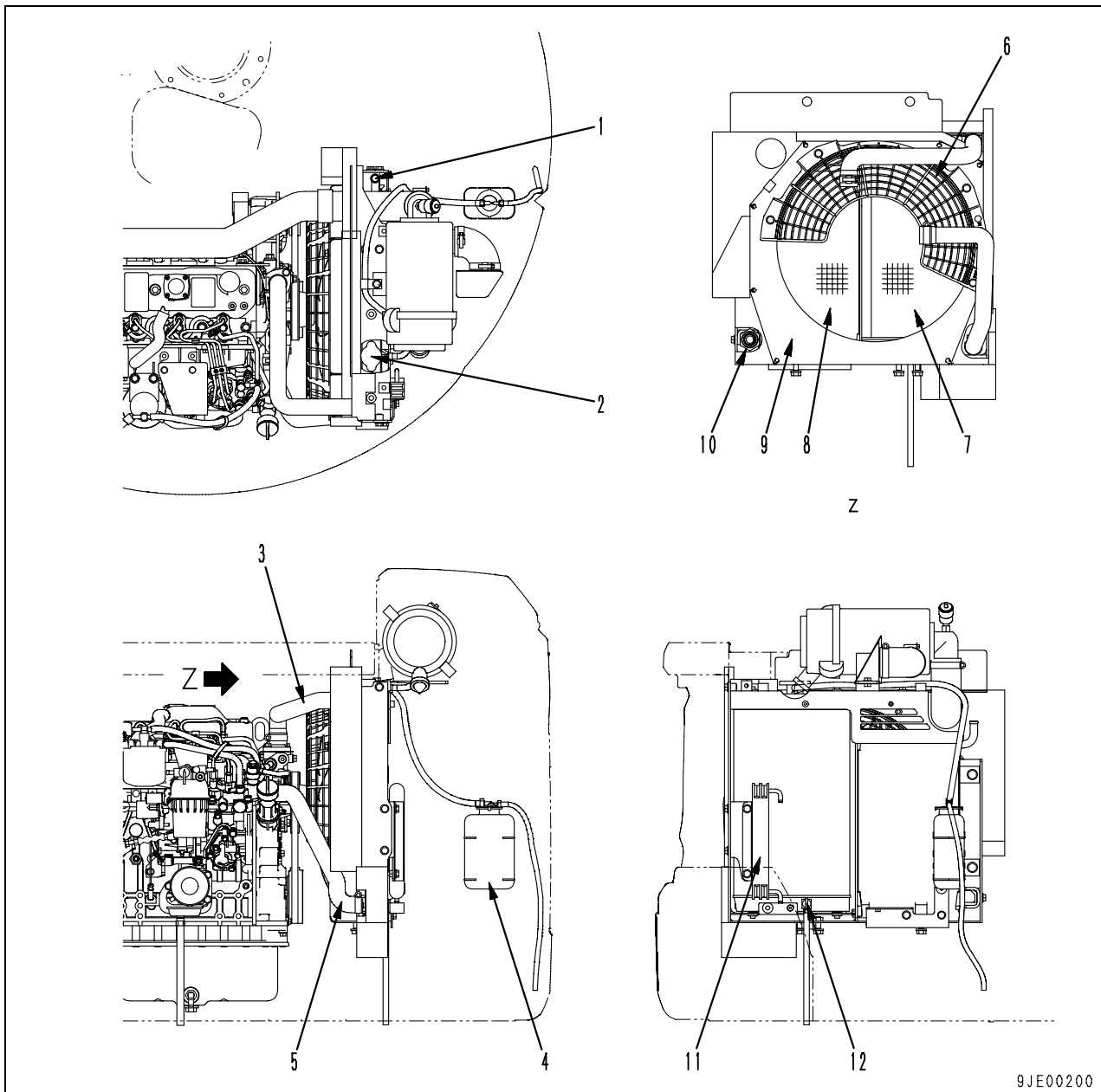
10 Structure, function and maintenance standard

100 Engine and cooling system

PTO.....	2
Cooling system	4

PTO

1. Boss
2. Spring pin
3. Rubber
4. Cover
5. Hydraulic pump

Cooling system

1. Oil cooler outlet
2. Radiator cap
3. Radiator inlet hose
4. Reservoir tank
5. Radiator outlet hose
6. Fan guard

7. Radiator
8. Oil cooler
9. Shroud
10. Oil cooler inlet
11. Fuel cooler
12. Drain valve

Specifications

	Radiator	Oil cooler	Fuel cooler
Core type	CF34-1	Drawn-cup	Drawn-cup
Fin pitch (mm)	3.0 / 2	4.0 / 2	3.0 / 2
Total heat dissipation surface (m ²)	3.12	2.63	0.2
Pressure valve cracking pressure (kPa {kg/cm ² })	88.3 ± 14.7 {0.9 ± 0.15}	—	—
Vacuum valve cracking pressure (kPa {kg/cm ² })	4.9 {0.05}	—	—

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

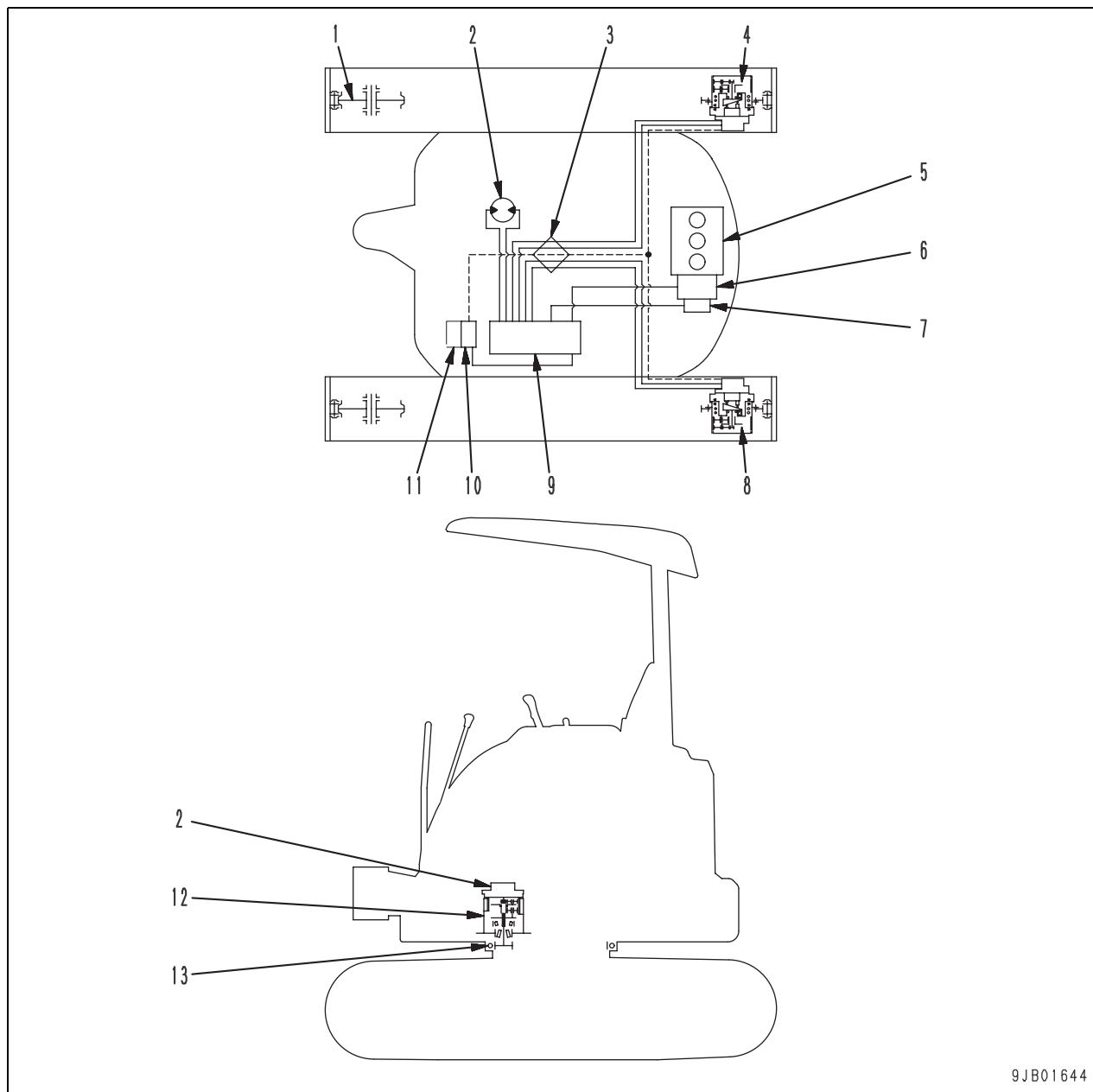
PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

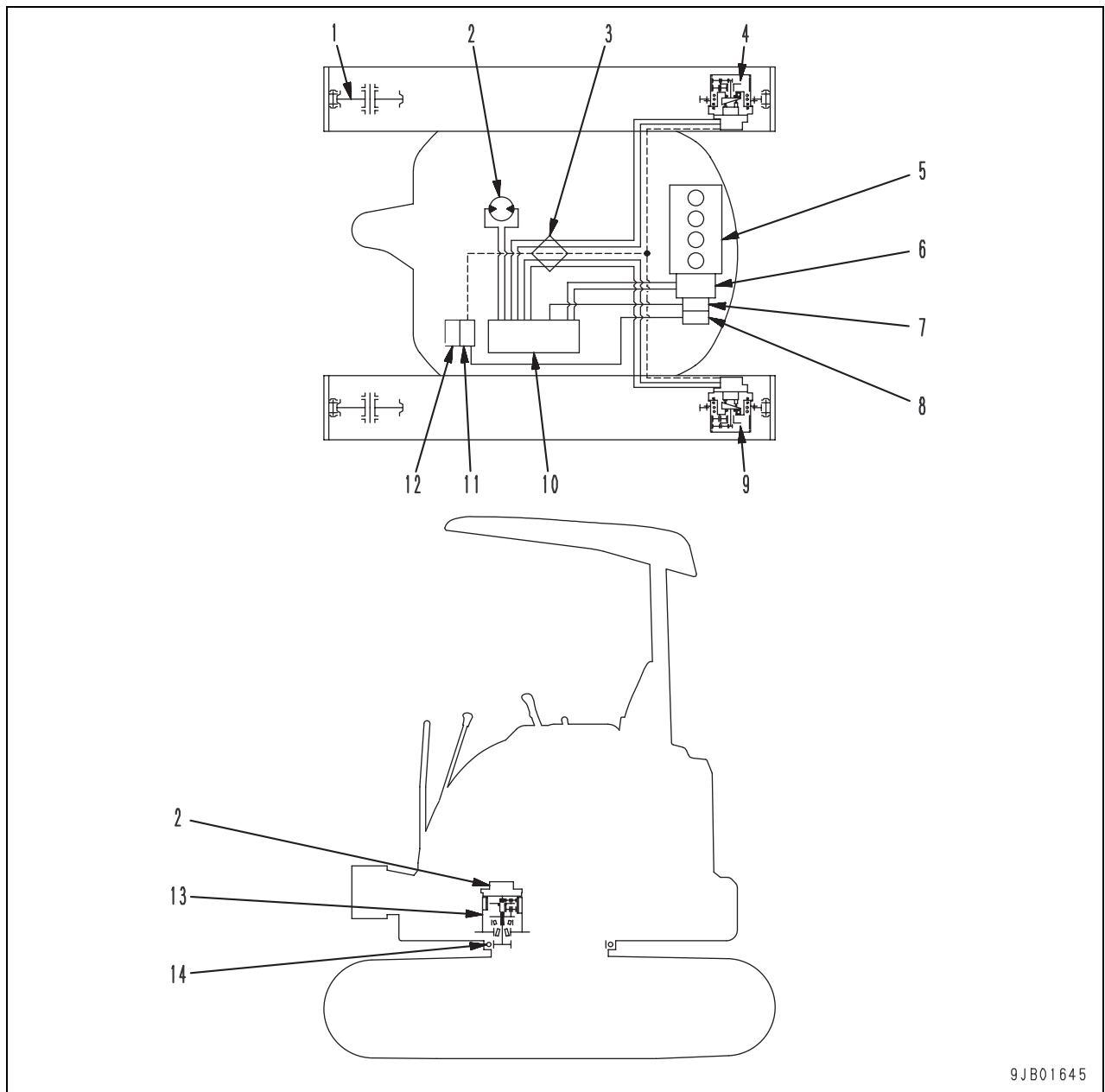
200 Power train

Power train.....	2
Swing circle.....	4
Swing machinery.....	5

Power train**PC27MR, 30MR-3**

- | | |
|---|---------------------------------------|
| 1. Idler | 8. Left travel motor |
| 2. Swing motor | 9. Control valve |
| 3. Center swivel joint | 10. Travel Hi-Lo speed selector valve |
| 4. Right travel motor | 11. PPC lock solenoid valve |
| 5. Engine | 12. Swing machinery |
| 6. Hydraulic pump (For work equipment and travel) | 13. Swing circle |
| 7. Hydraulic pump (For swing and blade) | |

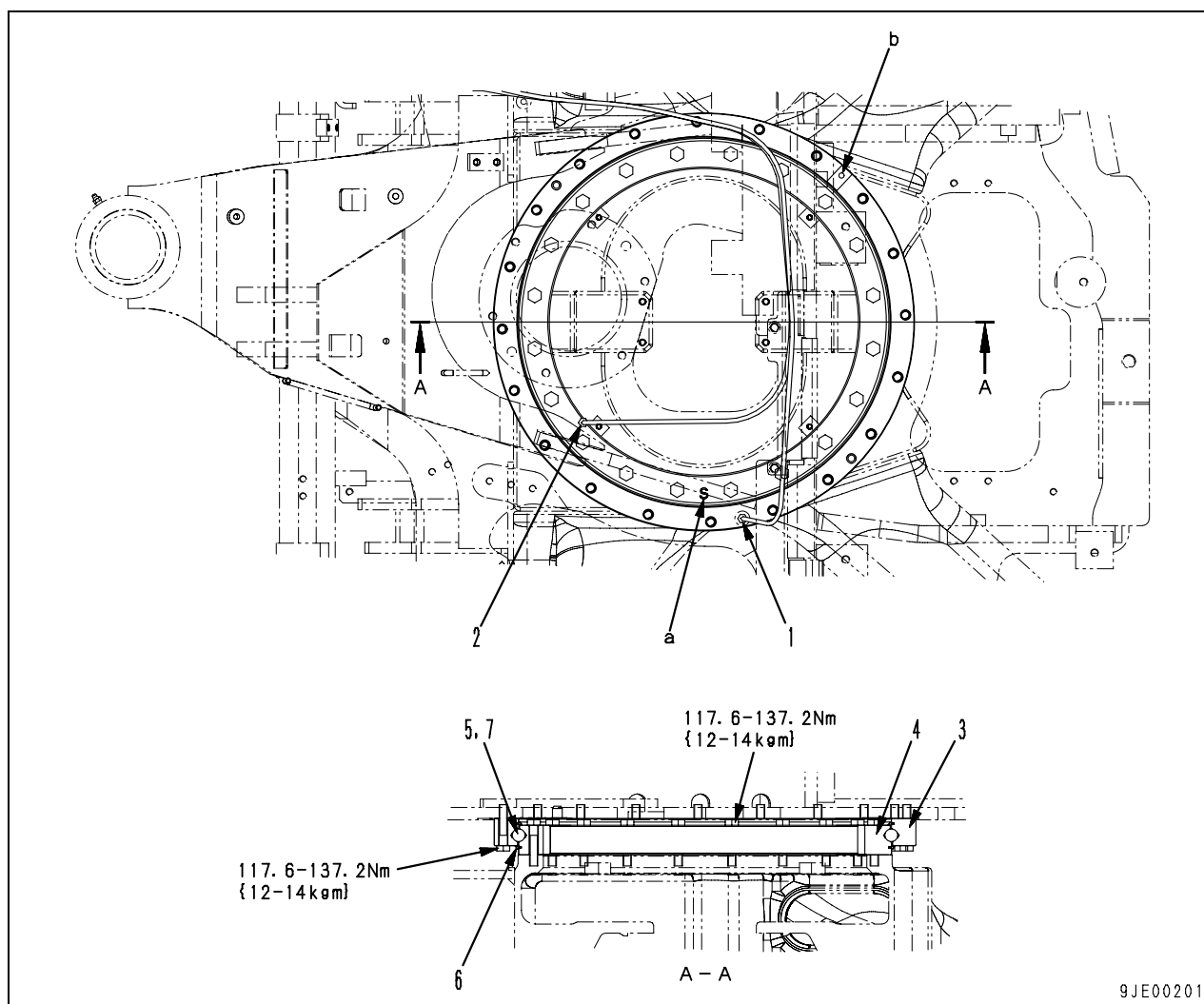
PC35MR-3



9JB01645

- | | |
|---|---------------------------------------|
| 1. Idler | 8. Hydraulic pump (For pilot) |
| 2. Swing motor | 9. Left travel motor |
| 3. Center swivel joint | 10. Control valve |
| 4. Right travel motor | 11. Travel Hi-Lo speed selector valve |
| 5. Engine | 12. PPC lock solenoid valve |
| 6. Hydraulic pump (For work equipment and travel) | 13. Swing machinery |
| 7. Hydraulic pump (For swing and blade) | 14. Swing circle |

Swing circle



1. Swing circle bearing lubricator
2. Swing circle pinion lubricator
3. Outer race
4. Inner race
5. Ball
6. Seal

- a. Inner race soft zone position
- b. Outer race soft zone position

Specifications

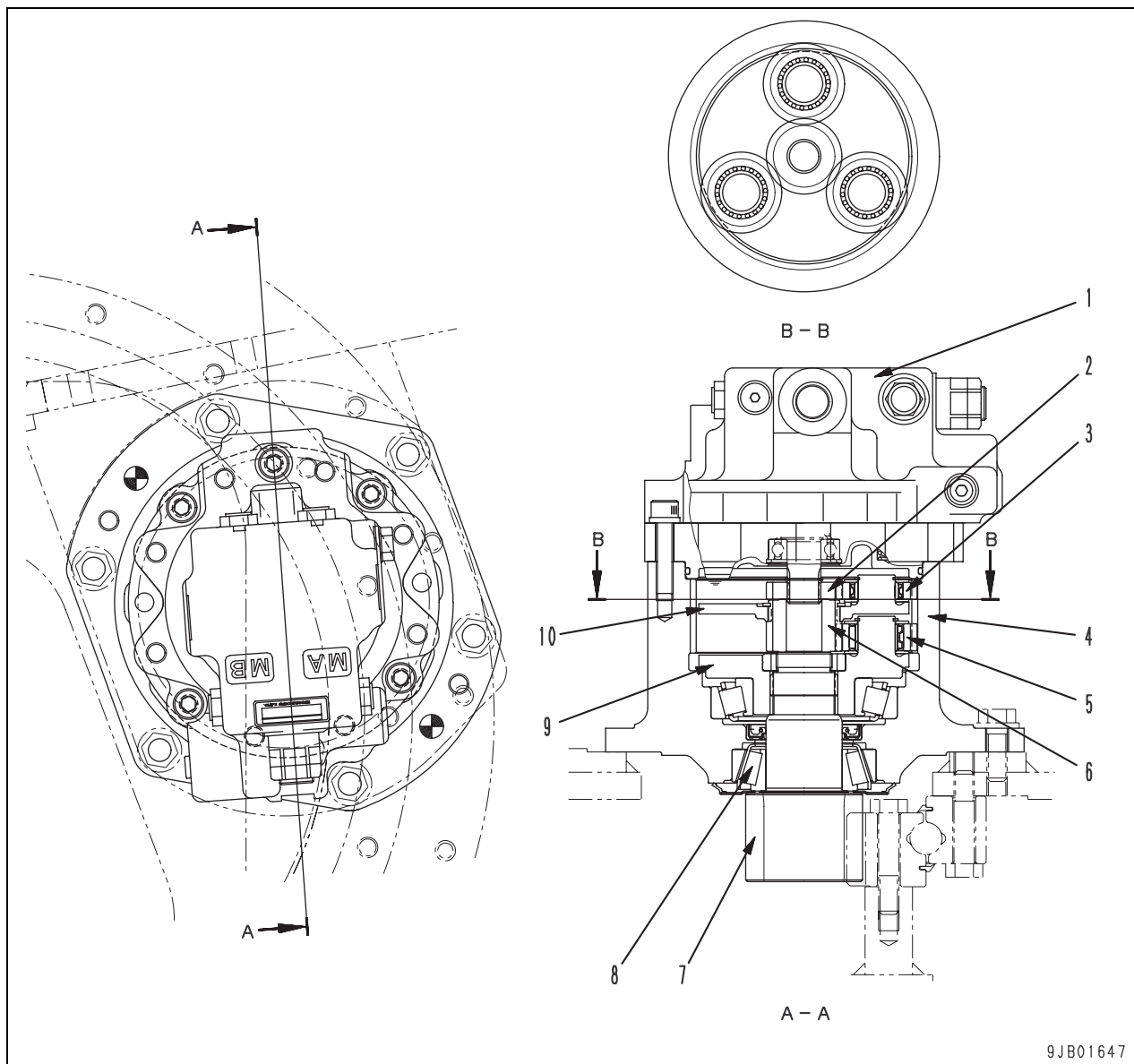
Reduction ratio: $92 / 11 = 8.36$

Grease: G2-LI

Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Repair limit	
7	Clearance between bearing	0.20 – 0.70	1.4	Replace

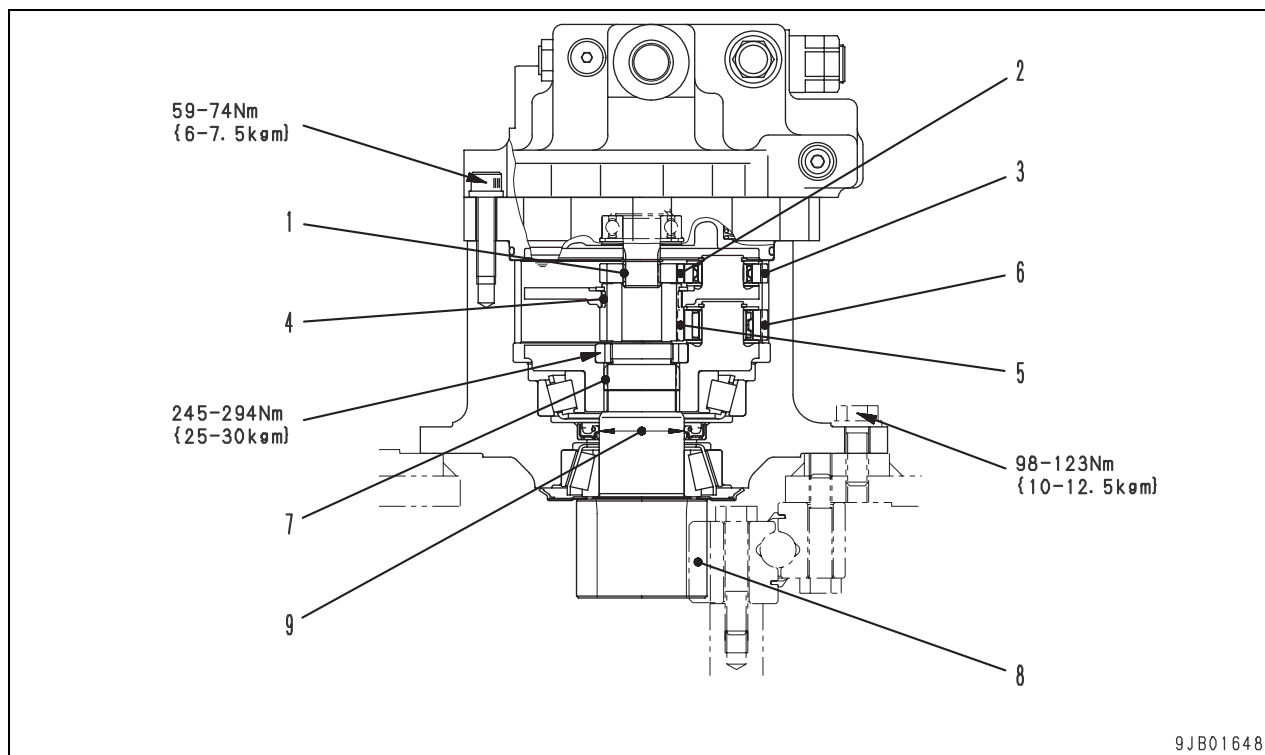
Swing machinery



1. Swing motor
2. No.1 sun gear (No. of tooth: 23)
3. No.1 planetary gear (No. of tooth: 25)
4. Swing machinery case (No. of tooth: 73)
5. No. 2 planetary gear (No. of tooth: 25)
6. No.2 sun gear (No. of tooth: 23)
7. Swing pinion (No. of tooth: 11)
8. Taper roller bearing
9. No. 2 planetary carrier
10. No. 1 planetary carrier

Specifications

Reduction ratio	$(23+73) / 23 \times (23+73) / 23 = 17.42$
Swing reduction ratio	$17.42 \times 8.36 = 145.71$
Swing speed (rpm)	9.3
Lubrication oil	SAE10W
Oil amount (ℓ)	0.9



Unit: mm

No.	Check item	Criteria			Remedy
1	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance		Repair limit	Replace
		0.04 – 0.11		—	
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.09 – 0.25		0.6	
3	Backlash between No. 1 planetary gear and swing machinery case	0.10 – 0.33		0.6	
4	Backlash between No. 1 planetary gear and No. 2 sun gear	0.10 – 0.21		—	
5	Backlash between No. 2 sun gear and No. 2 planetary gear	0.09 – 0.25		0.6	
6	Backlash between No. 2 planetary gear and swing machinery case	0.10 – 0.33		0.6	
7	Backlash between No. 2 planetary carrier and swing pinion	0.016 – 0.097		—	
8	Backlash between swing pinion and swing circle	0.12 – 0.68		2.0	
9	Wear of oil seal sliding surface of swing pinion	Standard size	Tolerance	Repair limit	Repair by hard chromium plating or replace
		45	0 –0.062	44.8	

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04071-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

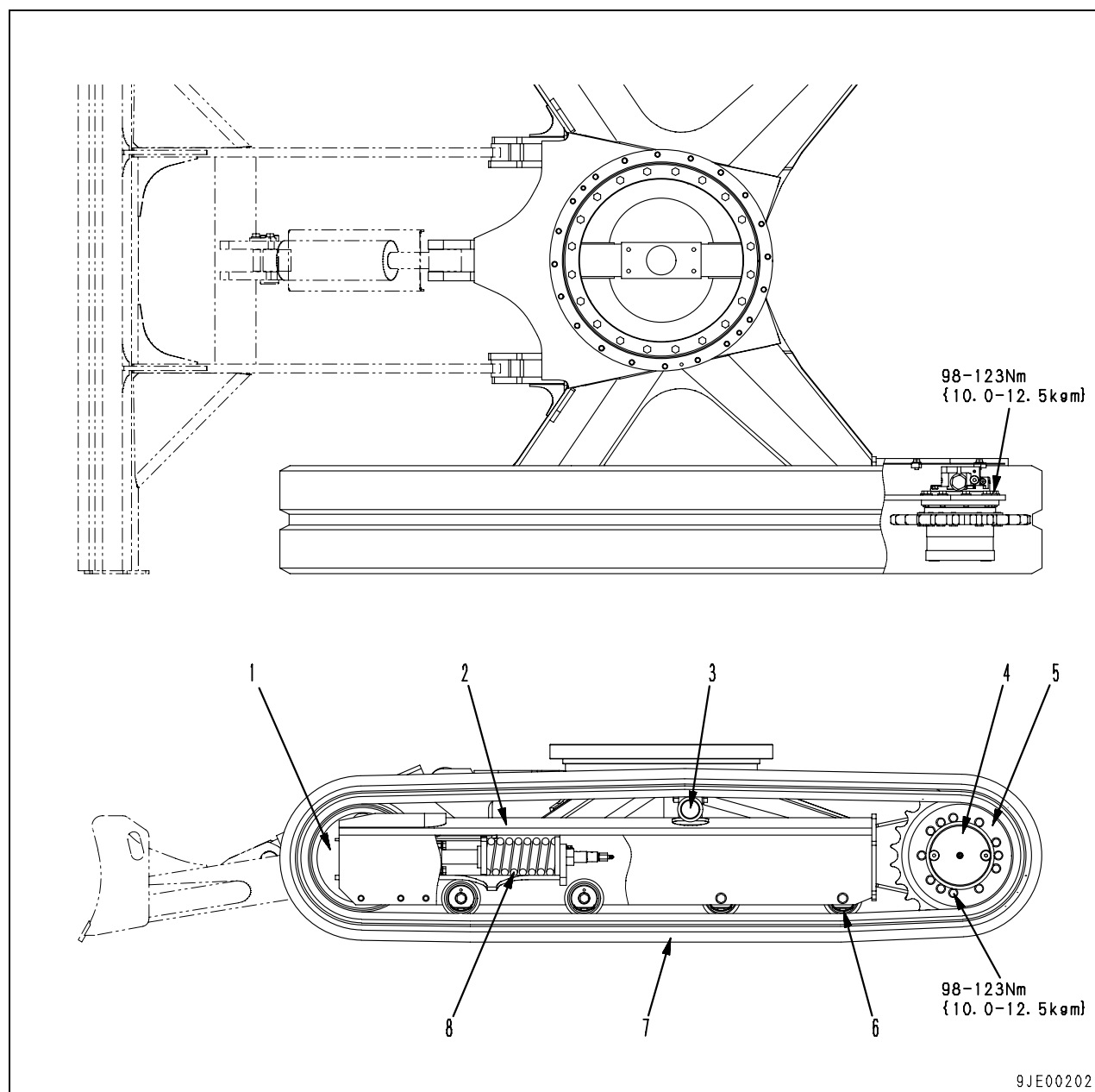
PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

300 Undercarriage and frame

Track frame	2
Idler cushion.....	3
Idler	4
Track roller	6
Carrier roller	7
Sprocket	8
Track shoe	9

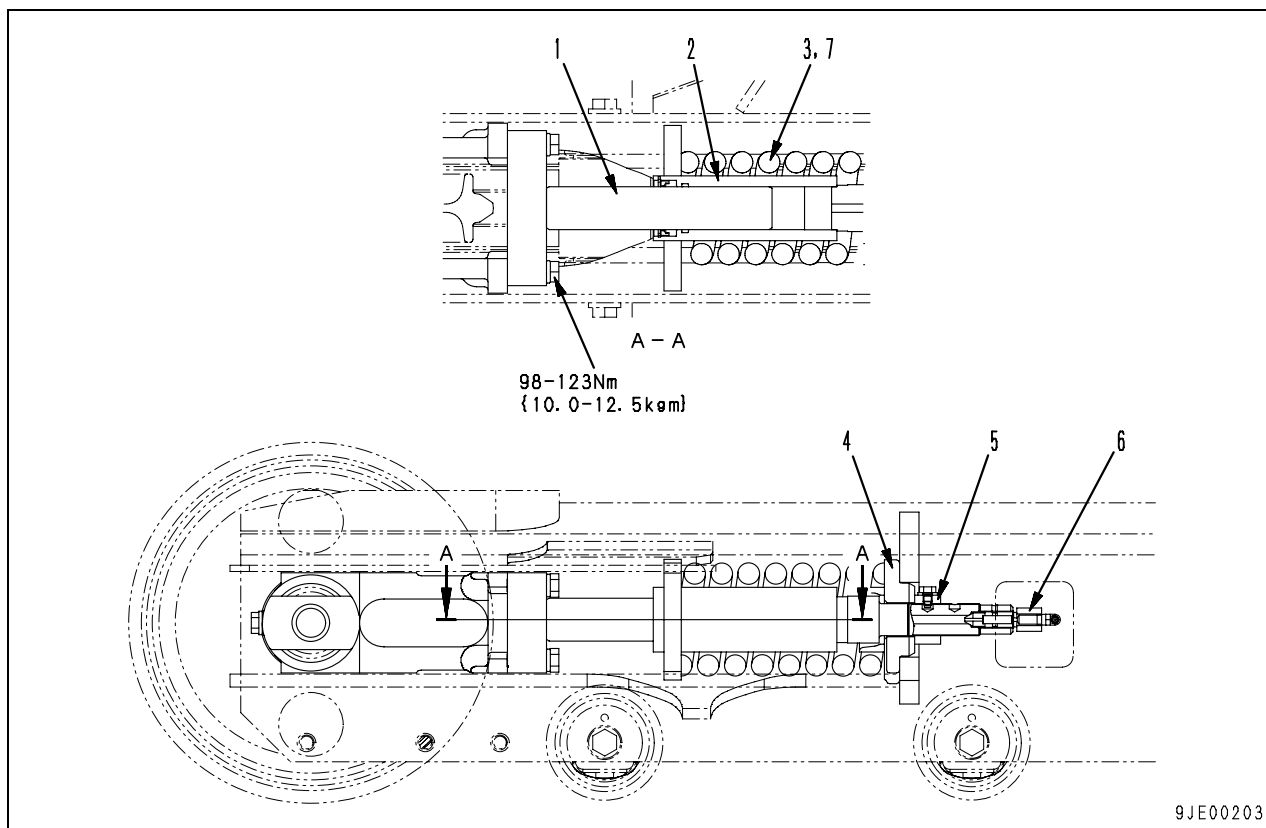
Track frame

1. Idler
2. Track frame
3. Carrier roller
4. Travel motor

5. Sprocket
6. Track roller
7. Track shoe
8. Idler cushion

Idler cushion

★ The following figure shows the rubber shoe specification.



1. Rod
2. Cylinder
3. Recoil spring
4. Rear support
5. Nut
6. Lubricator

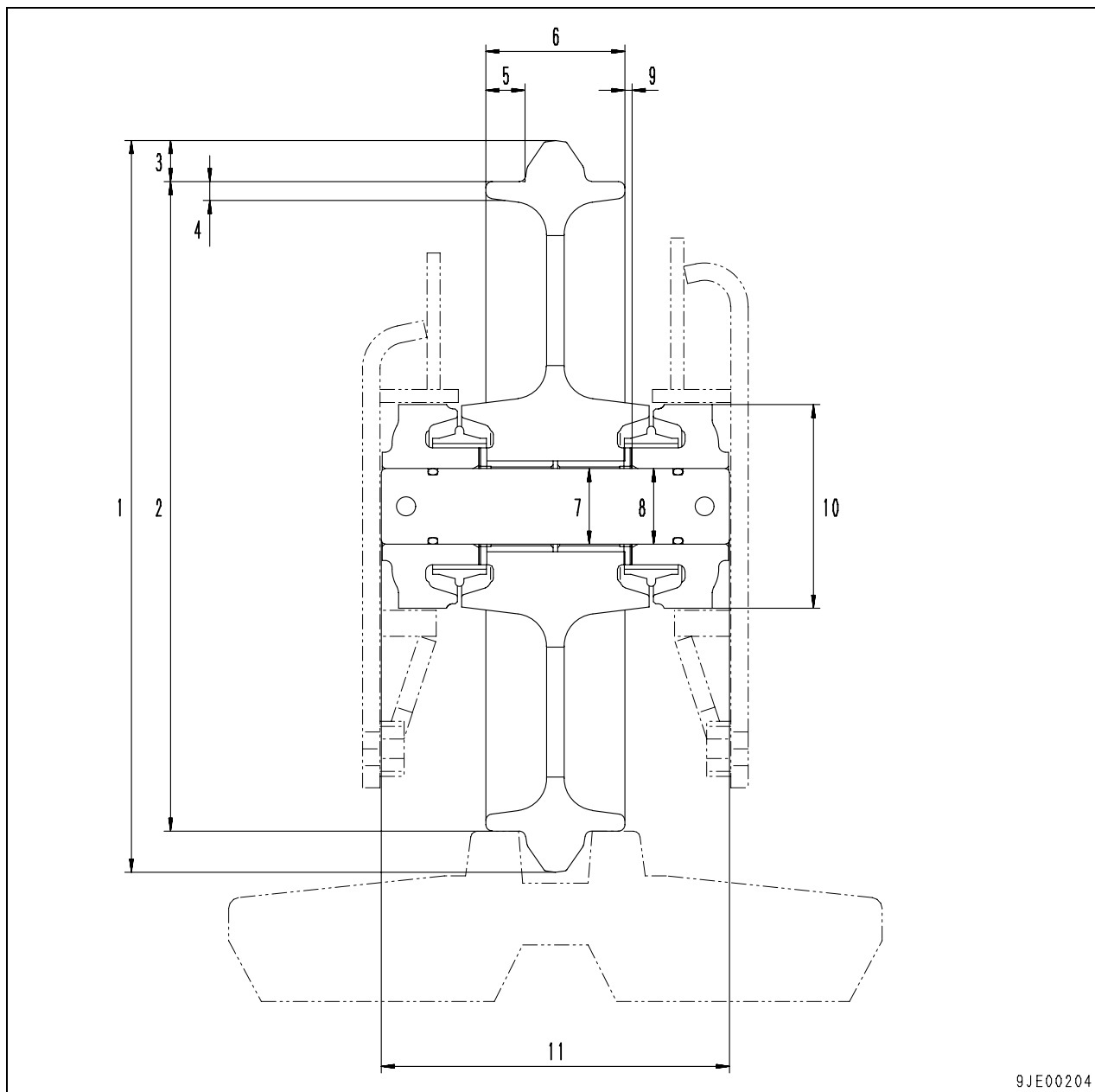
Specifications

Grease: G2-LI

Amount of grease (mℓ): 120

Unit: mm

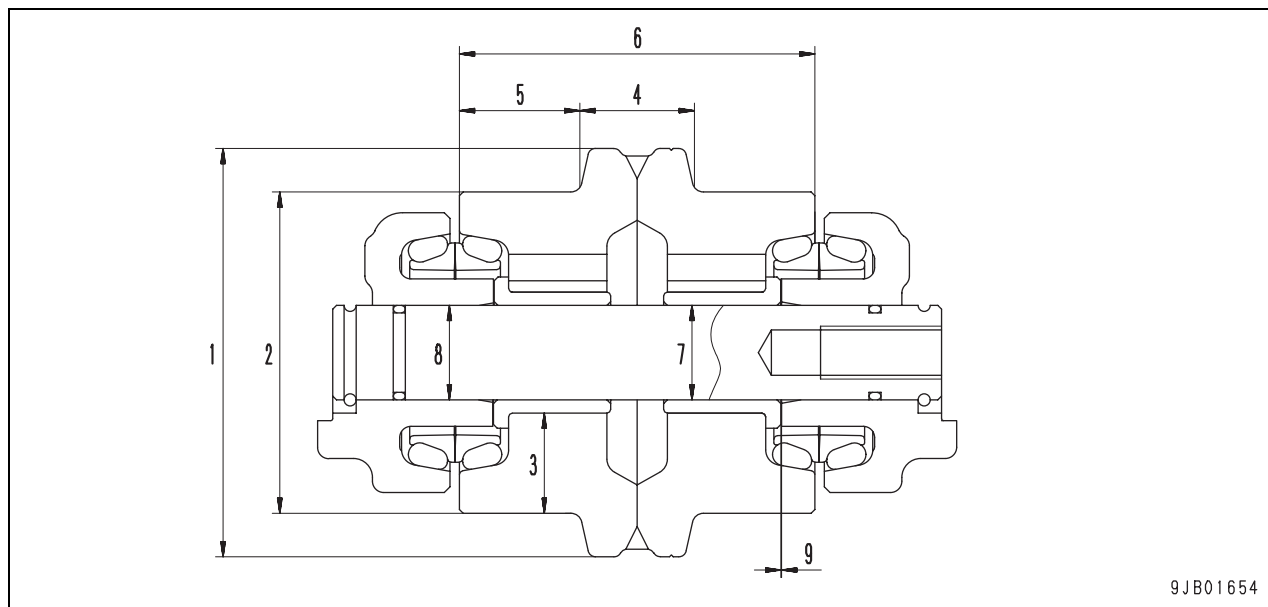
No.	Check item	Criteria					Remedy
7	Recoil spring (Rubber shoe spec.)	Standard clearance			Repair limit		Replace
		Free length	Installed length	Installed load	Free length	Installed load	
		257	188	30.9 kN {3,153 kg}	251	28.5 kN {2,901 kg}	
	Recoil spring (Steel shoe spec.) (Road liner spec.)	257	213	19.7 kN {2,012 kg}	251	17.6 kN {1,791 kg}	

Idler

Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of projection	Standard size		Repair limit			Repair by over-laying welding or replace
		338		—			
2	Outside diameter of tread	300		292			
3	Depth of tread	19		23			
4	Thickness of tread	8.7		4.7			
5	Width of tread	18		22			
6	Total width	64		—			
7	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		35	− 0.025 − 0.064	+ 0.142 + 0.080	0.105 − 0.206	—	
8	Clearance between shaft and support	35	− 0.025 − 0.064	+ 0.060 0	0.025 − 0.124	—	
9	Play of shaft in axial direction	Standard clearance		Clearance limit			
		0.25		—			
10	Height of idler guide	Track frame	95.5		100		
		Idler support	94		90		
11	Width of idler guide	Track frame	161.5		165		Repair by over-laying welding or replace
		Idler shaft	160		155		

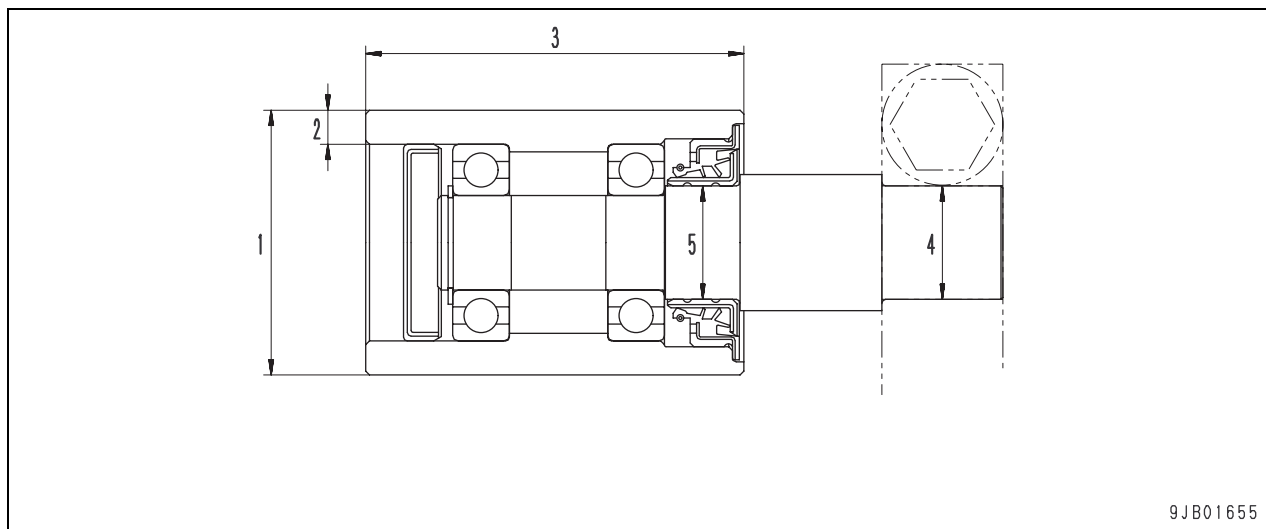
Track roller



Unit: mm

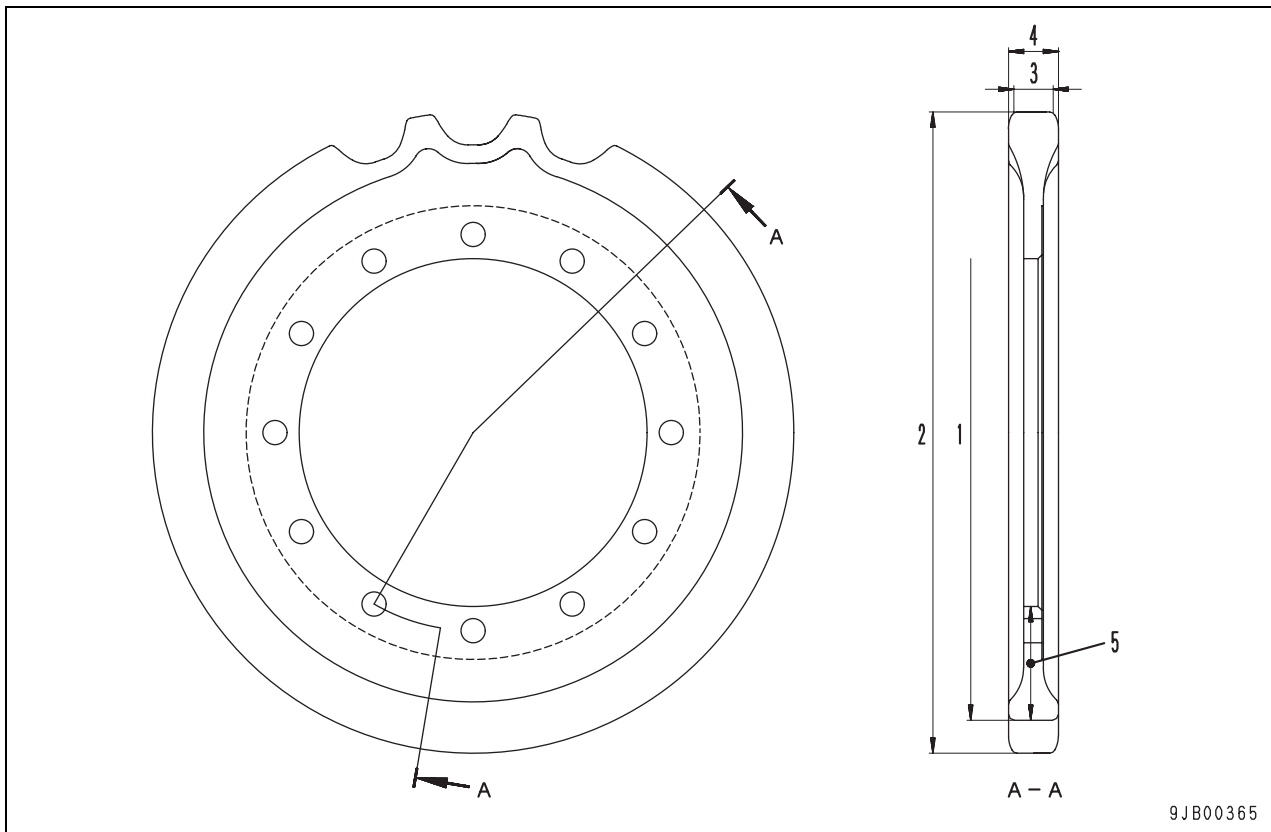
No.	Check item	Criteria				Remedy	
1	Outside diameter of flange	Standard size		Repair limit		Repair by over-laying welding or replace	
		108		—			
2	Outside diameter of tread	85		77			
3	Thickness of tread	26.5		22.5			
4	Width of flange	30.3		24.3			
5	Width of tread	31.85		—			
6	Total width	94		—			
7	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		25	0 – 0.013	+ 0.183 + 0.144	0.144 – 0.195	—	
8	Clearance between shaft and collar	25	0 – 0.013	+ 0.033 0	0 – 0.046	—	Replace
9	Play of roller in axial direction	Standard clearance		Clearance limit			
		0.15 – 0.32		—			

Carrier roller



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of tread	Standard size		Repair limit			Repair by over-laying welding or replace
		70		65			
2	Thickness of tread	9		6.5			
3	Width of tread	100		—			
4	Clearance between shaft and support	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		30	− 0.050 − 0.100	+ 0.210 0	0.050 − 0.310	—	
5	Interference between shaft and seal	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		30	0 − 0.052	− 0.200 − 0.400	0.148 − 0.400	—	

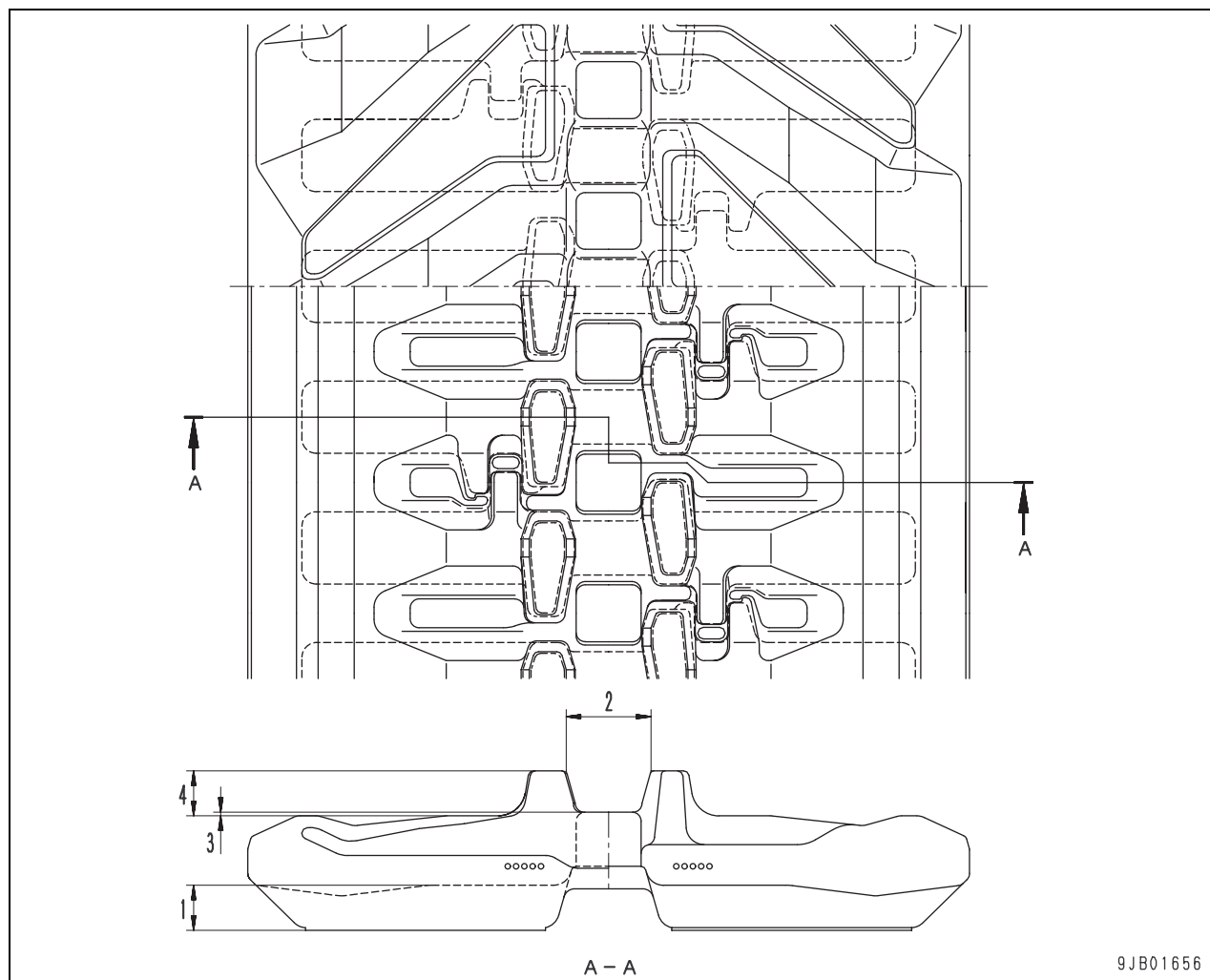
Sprocket

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Wear of root circle diameter	344.3	+ 1.0 - 2.0	332	Repair by over-laying welding or replace
2	Wear of tip circle diameter	386.2	± 1.5	374	
3	Wear of tip width	20	—	18	
4	Wear of bottom width	27	+ 0.5 - 1.0	24	
5	Thickness of bottom	77.15	+ 0.475 - 1.061	71	

Track shoe

Rubber shoe

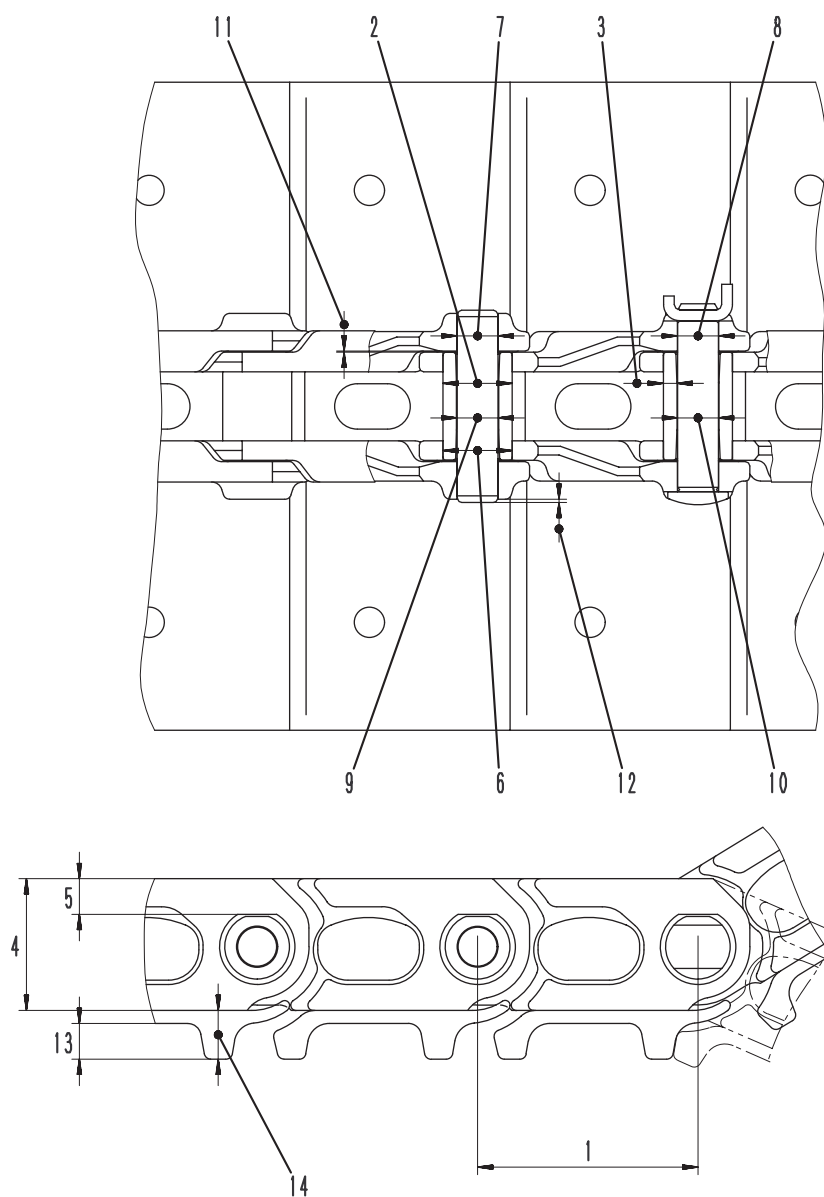


Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Wear of lug height	23	5	Replace
2	Wear of roller guide	34	42	
3	Wear of meshing parts of sprocket	- 1.5	- 6.5	
4	Wear of roller tread height	22.5	16.5	

Double grouser shoe

(If equipped)



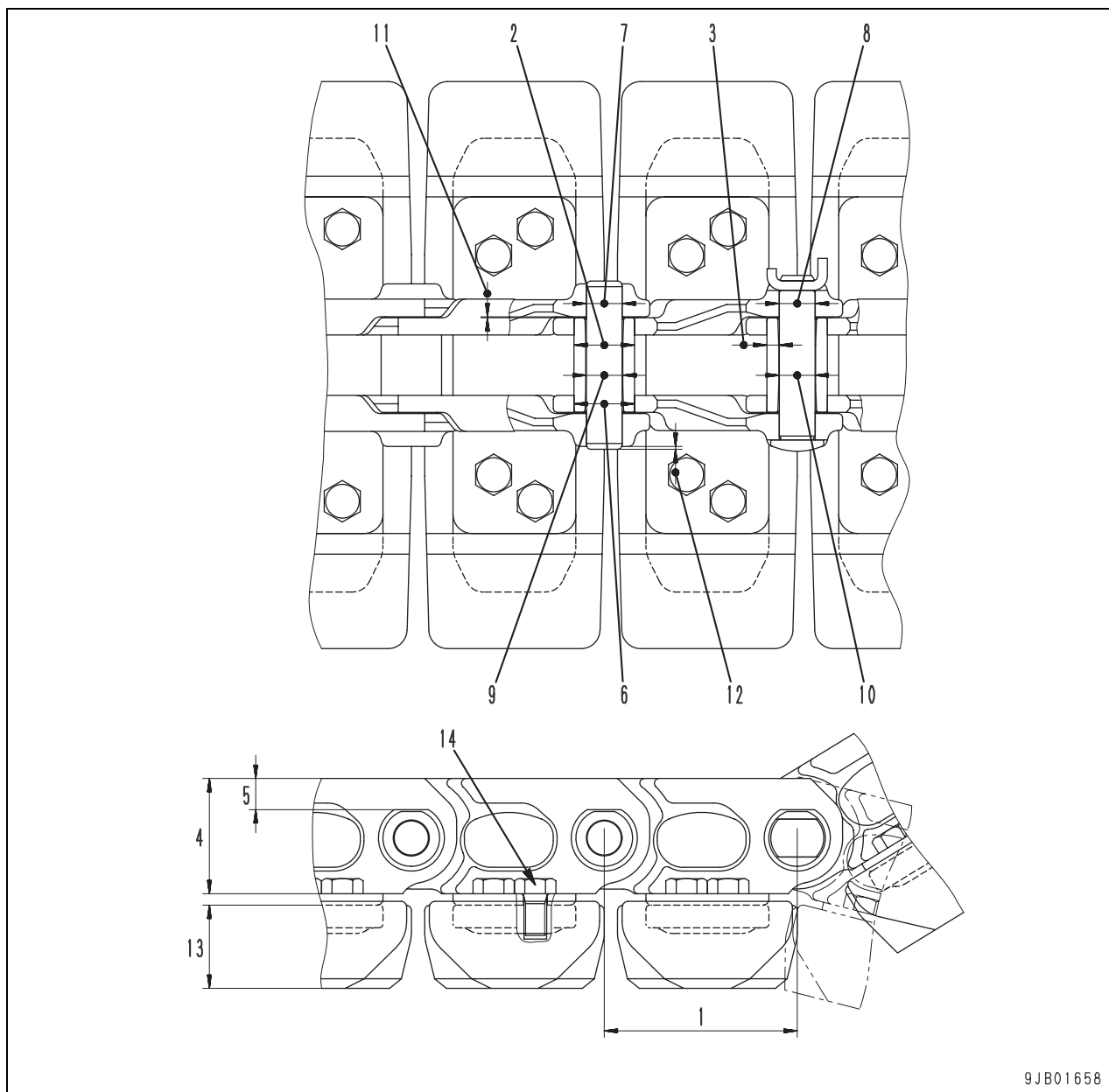
9JB01657

Unit: mm

No.	Check item	Criteria					Remedy
1	Link pitch	Standard size	Turning limit		Repair limit		If link pitch exceeds repair limit, replace bushing and pin.
		102	—		107		
2	Outside diameter of bushing	32	—		26		
3	Thickness of bushing	6.25	—		3.25		Turn or replace
4	Height of link	Standard size			Repair limit		Repair by over-laying welding or replace
		61			55		
5	Thickness of link (Bushing fitting part)	15.5			9.5		
6	Interference between bushing and link	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		32	+ 0.15 + 0.12	+ 0.05 0	0.07 – 0.15	—	
7	Interference between regular pin and link	19	+ 0.27 + 0.12	+ 0.05 0	0.07 – 0.27	—	
8	Clearance between master pin and link	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		Shaft 18.93 Hole 19	+ 0.05 0	+ 0.05 0	0.02 – 0.12	—	
9	Clearance between regular pin and bushing	Shaft 19 Hole 19.5	+ 0.27 + 0.12	± 0.20	0.03 – 0.58	—	
10	Clearance between master pin and bushing	Shaft 18.93 Hole 19.5	+ 0.05 0	± 0.20	0.32 – 0.77	—	
11	Clearance of link mating face	Standard clearance (Each side)		Standard clearance (Both sides)		Standard clearance (Each side)	Adjust
		0.2 – 0.9		0.4 – 1.8		—	
12	Projection of regular pin	1.5					
13	Height of grouser	Standard size			Repair limit		Weld lug or replace
		16.5			10		
14	Thickness of grouser	22			15.5		

Road liner

(If equipped)



Unit: mm

No.	Check item	Criteria					Remedy	
1	Link pitch	Standard size	Turning limit		Repair limit		If link pitch exceeds repair limit, replace bushing and pin.	
		102	—		107			
2	Outside diameter of bushing	32	—		26			
3	Thickness of bushing	6.25	—		3.25		Turn or replace	
4	Height of link	Standard size			Repair limit		Repair by over-laying welding or replace	
		61			55			
5	Thickness of link (Bushing fitting part)	15.5			9.5			
6	Interference between bushing and link	Standard size	Tolerance		Standard interference	Interference limit	Replace	
			Shaft	Hole				
		32	+ 0.15 + 0.12	+ 0.05 0	0.07 – 0.15	—		
7	Interference between regular pin and link	19	+ 0.27 + 0.12	+ 0.05 0	0.07 – 0.27	—		
8	Clearance between master pin and link	Standard size	Tolerance		Standard clearance	Clearance limit		
			Shaft	Hole				
		Shaft 18.93 Hole 19	+ 0.05 0	+ 0.05 0	0.02 – 0.12	—		
9	Clearance between regular pin and bushing	Shaft 19 Hole 19.5	+ 0.27 + 0.12	± 0.20	0.03 – 0.58	—		
10	Clearance between master pin and bushing	Shaft 18.93 Hole 19.5	+ 0.05 0	± 0.20	0.32 – 0.77	—		
11	Clearance of link mating face	Standard clearance (Each side)		Standard clearance (Both sides)		Standard clearance (Each side)		Adjust
		0.2 – 0.9		0.4 – 1.8		—		
12	Projection of regular pin	1.5						
13	Height of grouser	Standard size			Repair limit		Replace	
		44			20			
14	Tightening torque of shoe bolt	130 – 145 Nm {13 – 14.5 kgm}					Retighten	

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04072-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

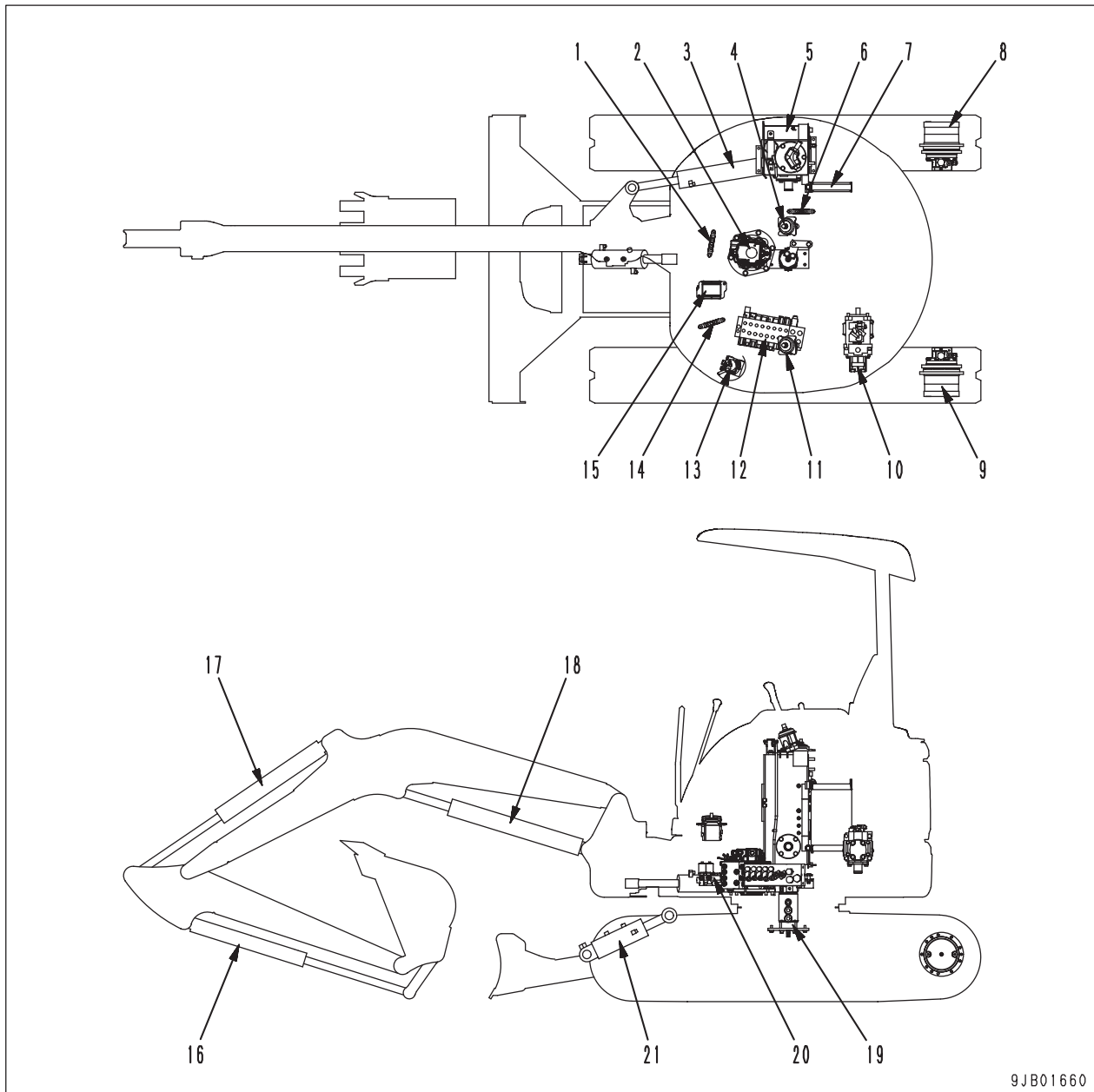
Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

410 Hydraulic system, Part 1

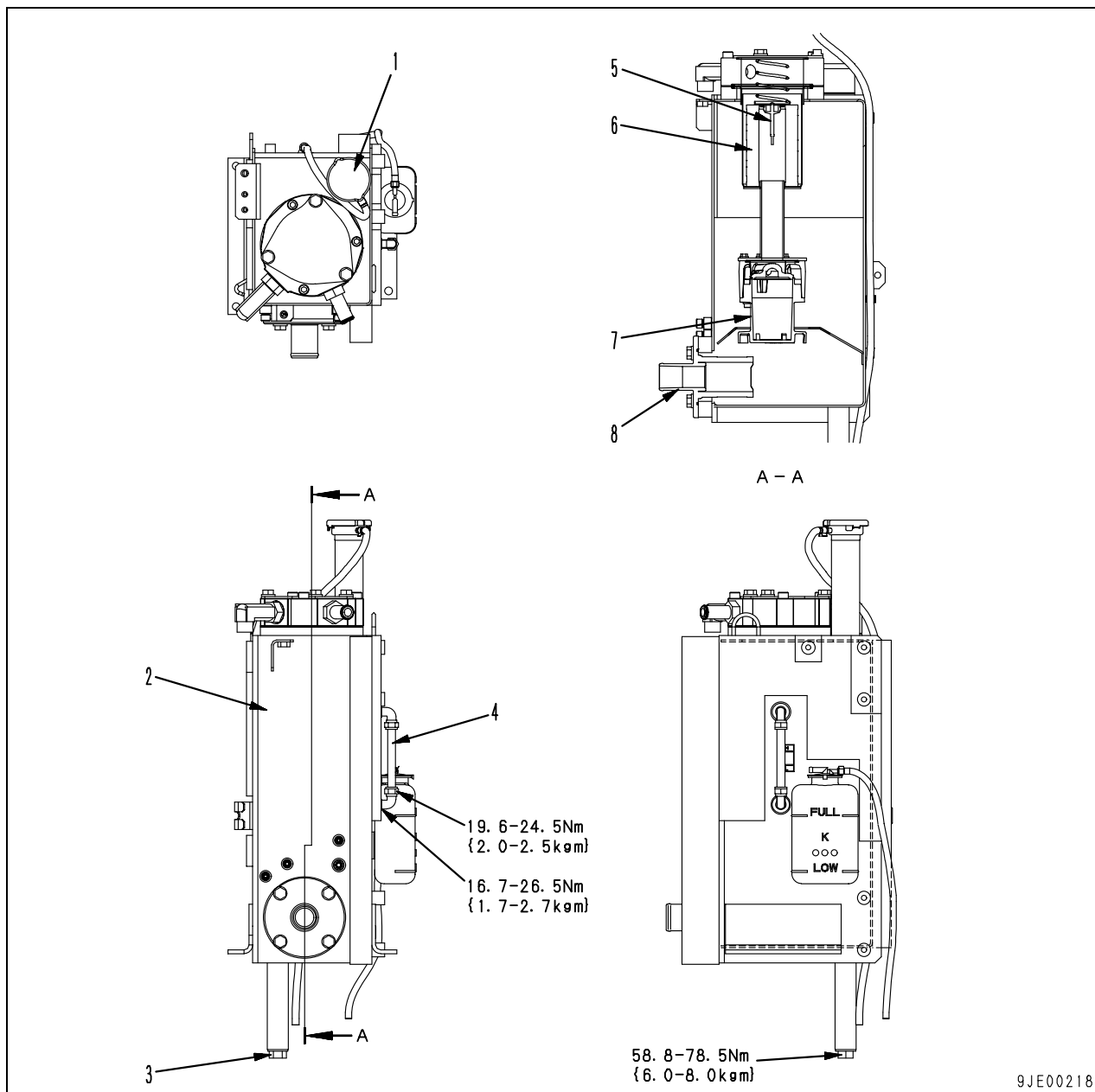
Hydraulic components layout drawing	2
Hydraulic tank, filter	3
Center swivel joint.....	5
Travel motor	7
Hydraulic cylinder.....	15
Solenoid valve.....	20
Multi-control valve	26

Hydraulic components layout drawing

9JB01660

- | | |
|-----------------------------------|--|
| 1. Boom swing PPC valve | 12. Control valve |
| 2. Swing motor | 13. Multi-control valve (If equipped) |
| 3. Boom swing cylinder | 14. Attachment PPC valve (If equipped) |
| 4. Right work equipment PPC valve | 15. Travel PPC valve |
| 5. Hydraulic tank | 16. Bucket cylinder |
| 6. Blade PPC valve | 17. Arm cylinder |
| 7. Oil cooler | 18. Boom cylinder |
| 8. Right travel motor | 19. Center swivel joint |
| 9. Left travel motor | 20. 2-spool solenoid valve |
| 10. Hydraulic pump | 21. Blade cylinder |
| 11. Left work equipment PPC valve | |

Hydraulic tank, filter

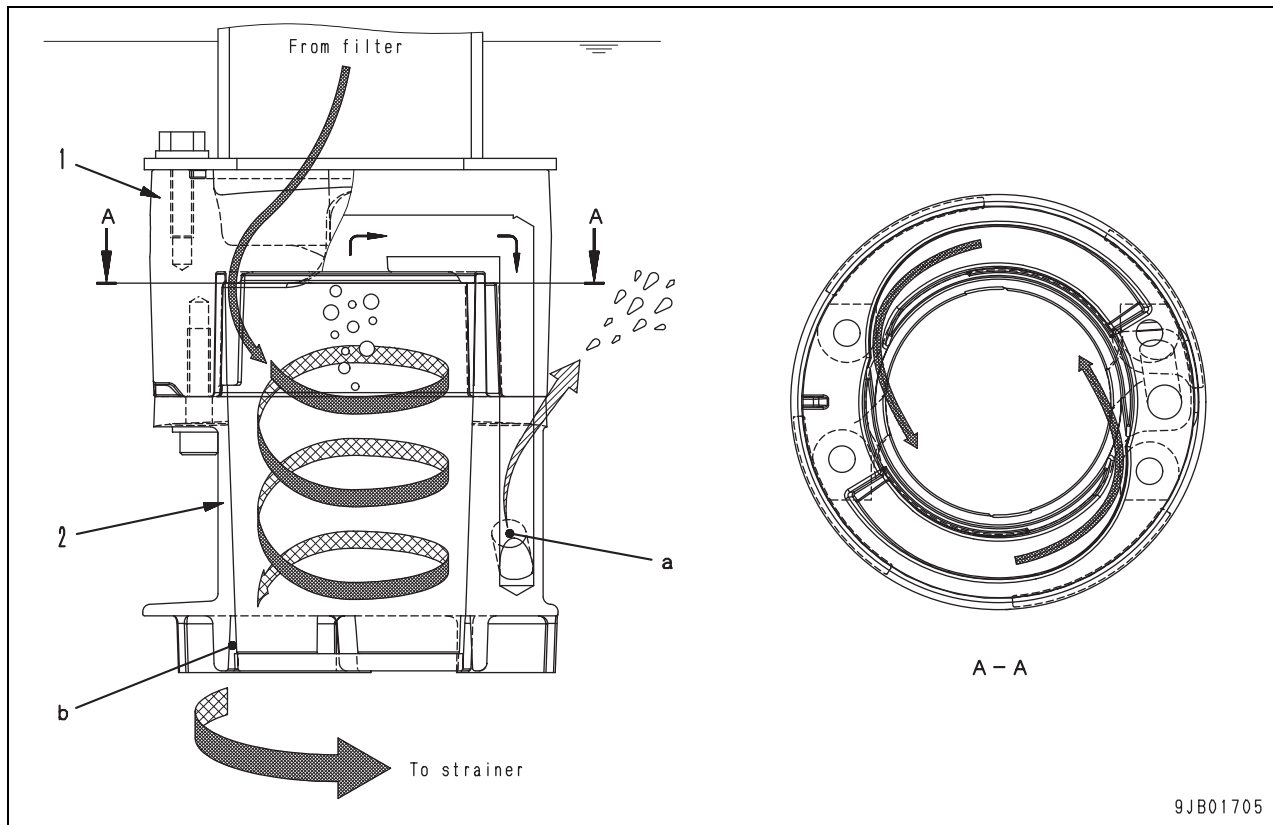


9JE00218

1. Filler cap
2. Hydraulic tank
3. Drain plug
4. Sight gauge
5. Bypass valve
6. Filter element
7. Cyclone assembly
8. Strainer

Specifications

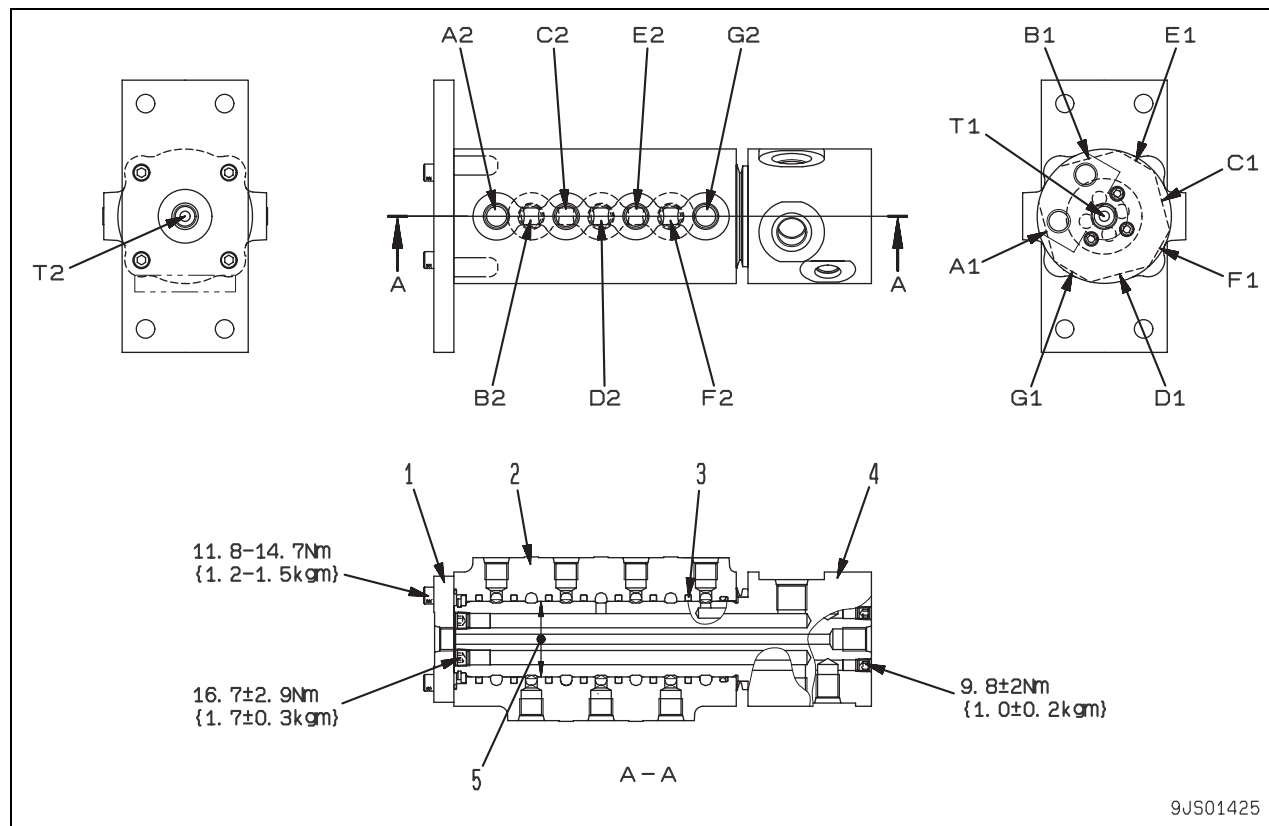
Tank capacity (ℓ)	21.8
Oil amount (ℓ)	13.5
Bypass valve set pressure (kPa {kg/cm ² })	150 ± 30 {1.53 ± 0.31}
Pressure valve cracking pressure (MPa {kg/cm ² })	90 ± 15 {0.9 ± 0.15}
Vacuum valve cracking pressure (kPa {kg/cm ² })	0 – 5 {0 – 0.05}

Operation of cyclone assembly

- The hydraulic oil returning from each actuator flows through the filter to block (1) of the cyclone assembly.
- When the hydraulic oil flows from block (1) into the cylindrical part of cyclone (2), it swirls and its speed is increased.
- Since the hydraulic oil swirls, a centrifugal force is generated and bubbles of low specific gravity gather to the center.
- The bubbles gathering to the center are discharged through the upper center of block (1) and outlet (a) on the side of cyclone (2) into the hydraulic oil in the tank. The hydraulic oil and air are separated in this way.
- The hydraulic oil containing no bubbles is discharged through outlet (b) at the bottom of cyclone (2), and then it flows through the strainer into the pump again.

Center swivel joint

PC27MR-3



A1 : From R.H. travel control valve

A2 : To R.H. travel motor

B1 : From L.H. travel control valve

B2 : To L.H. travel motor

C1 : From R.H. travel control valve

C2 : To R.H. travel motor

D1 : From L.H. travel control valve

D2 : To L.H. travel motor

E1 : From blade control valve

E2 : To blade cylinder head

F1 : From blade control valve

F2 : To blade cylinder bottom

G1 : From travel Hi-Lo speed selector solenoid valve

G2 : To travel Hi-Lo speed selector valve

T1 : To hydraulic tank

T2 : From travel motor drain port

1. Cover

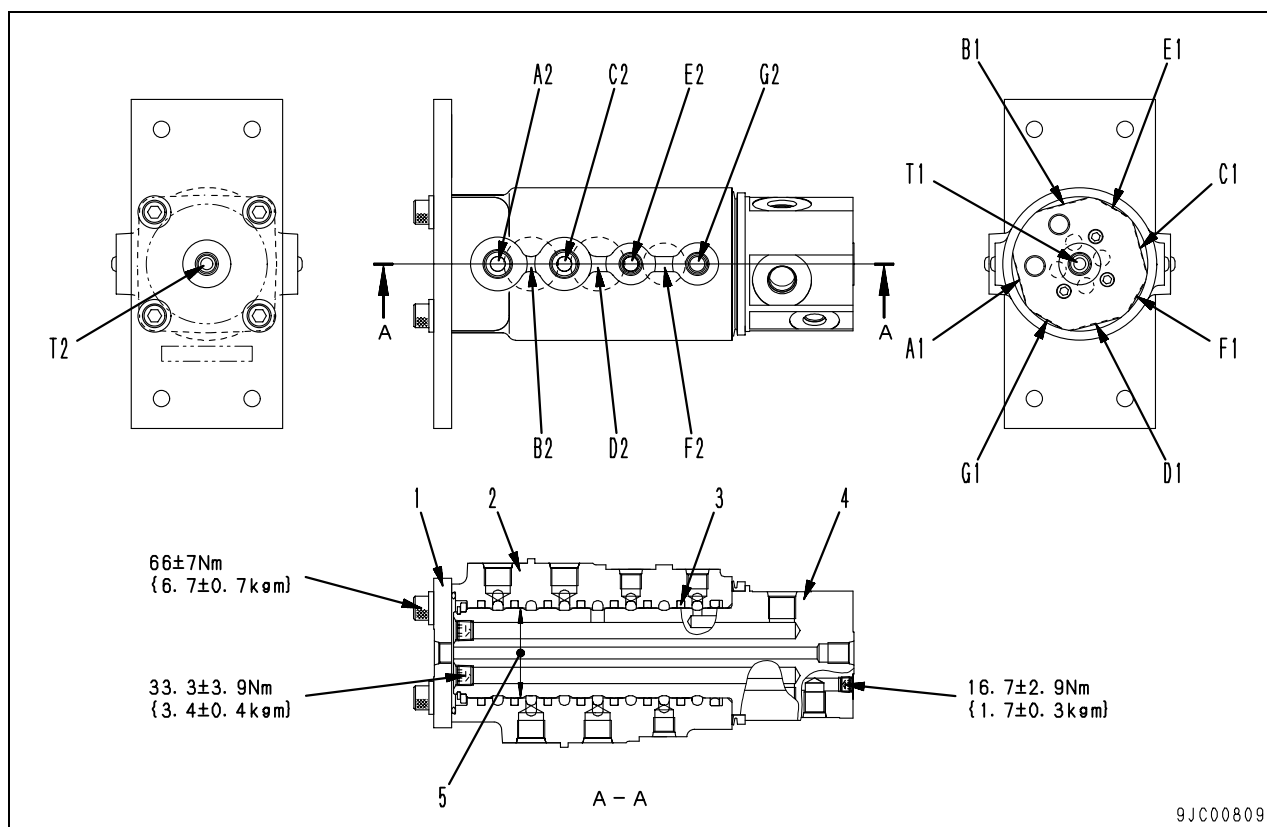
2. Rotor

3. Slipper seal

4. Shaft

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Standard clearance	Clearance limit	
5	Clearance between rotor and shaft	60	0.055 – 0.085	0.090	Replace

PC30MR, 35MR-3

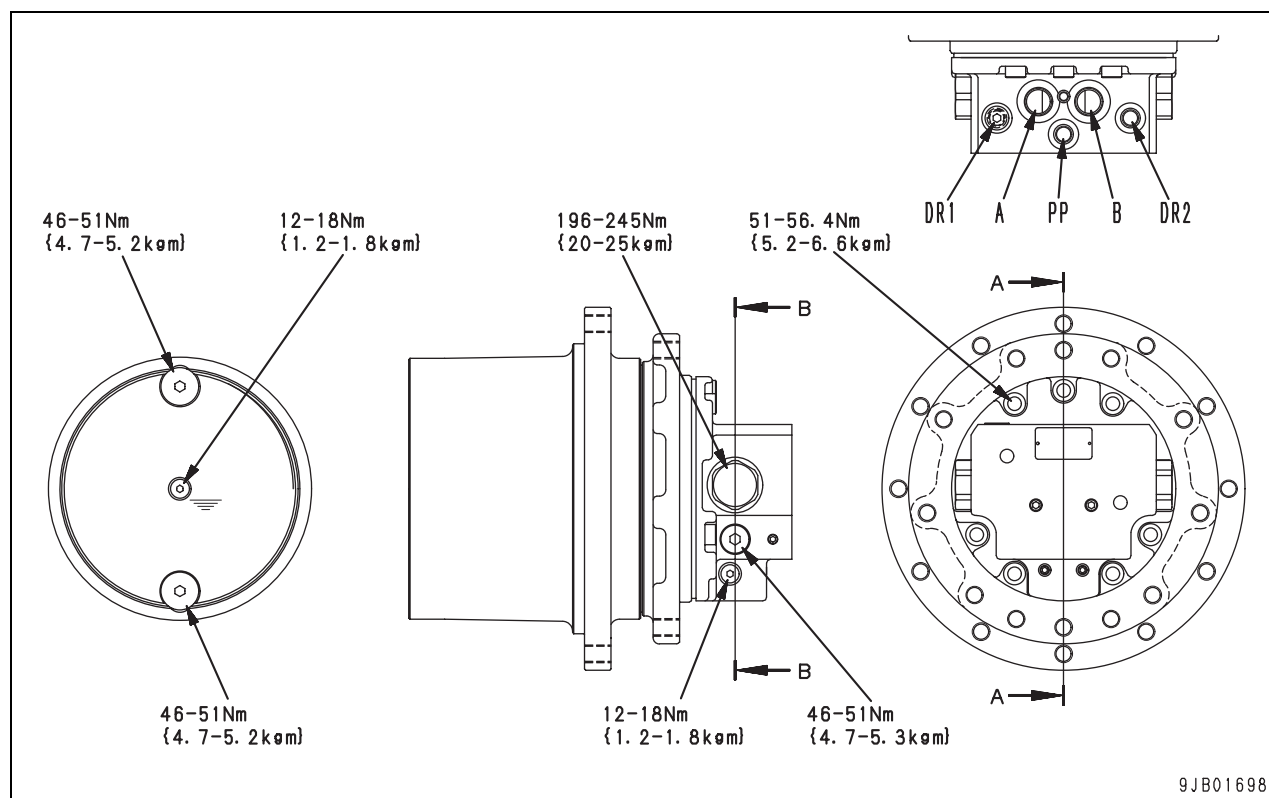
A1 : From R.H. travel control valve
 A2 : To R.H. travel motor
 B1 : From L.H. travel control valve
 B2 : To L.H. travel motor
 C1 : From R.H. travel control valve
 C2 : To R.H. travel motor
 D1 : From L.H. travel control valve
 D2 : To L.H. travel motor
 E1 : From blade control valve
 E2 : To blade cylinder head
 F1 : From blade control valve
 F2 : To blade cylinder bottom
 G1 : From travel Hi-Lo speed selector valve
 G2 : To travel Hi-Lo speed selector valve
 T1 : To hydraulic tank
 T2 : From travel motor drain port

1. Cover
2. Rotor
3. Slipper seal
4. Shaft

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Standard clearance	Clearance limit	
5	Clearance between rotor and shaft	60	0.055 – 0.085	0.090	Replace

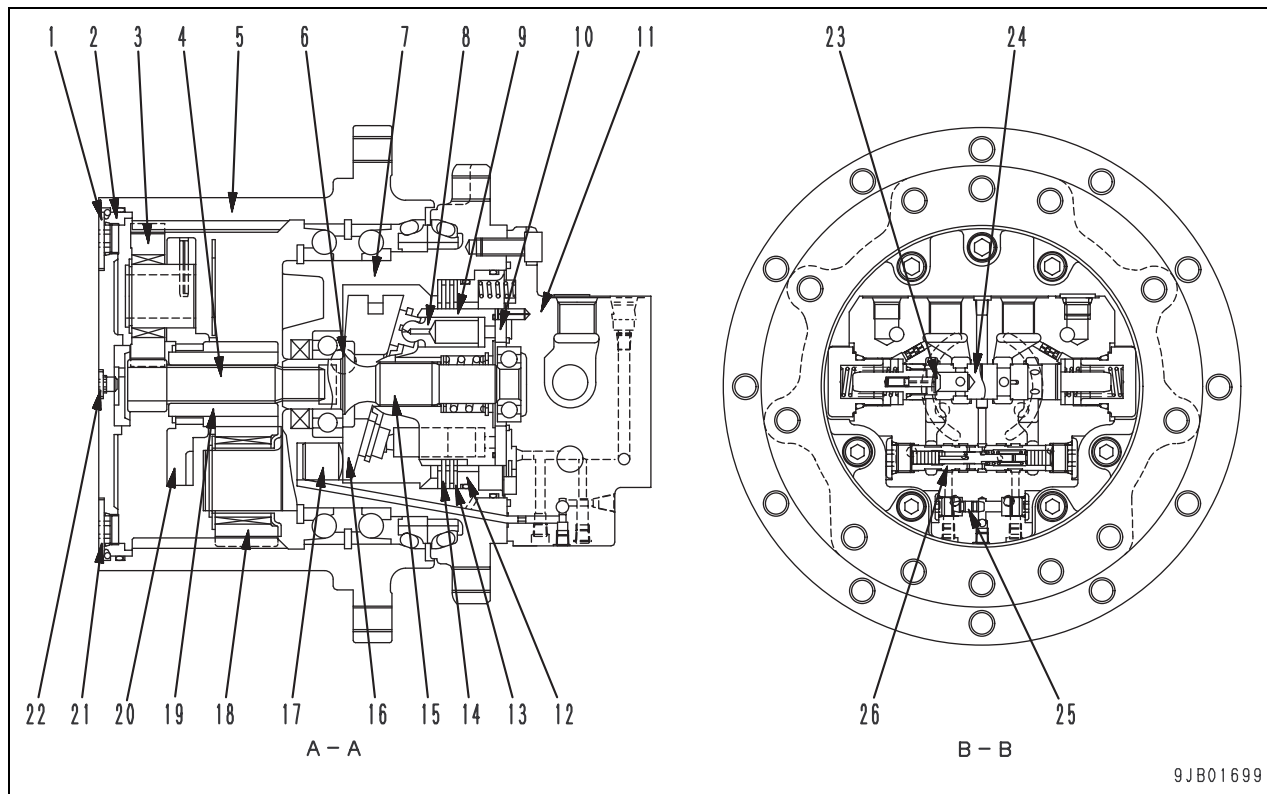
Travel motor



- A : From travel control valve
 B : From travel control valve
 PP : From travel speed Hi-Lo selector solenoid valve
 DR1: To tank (left side)
 Plug (right side)
 DR2: Plug (left side)
 To tank (right side)

Specifications

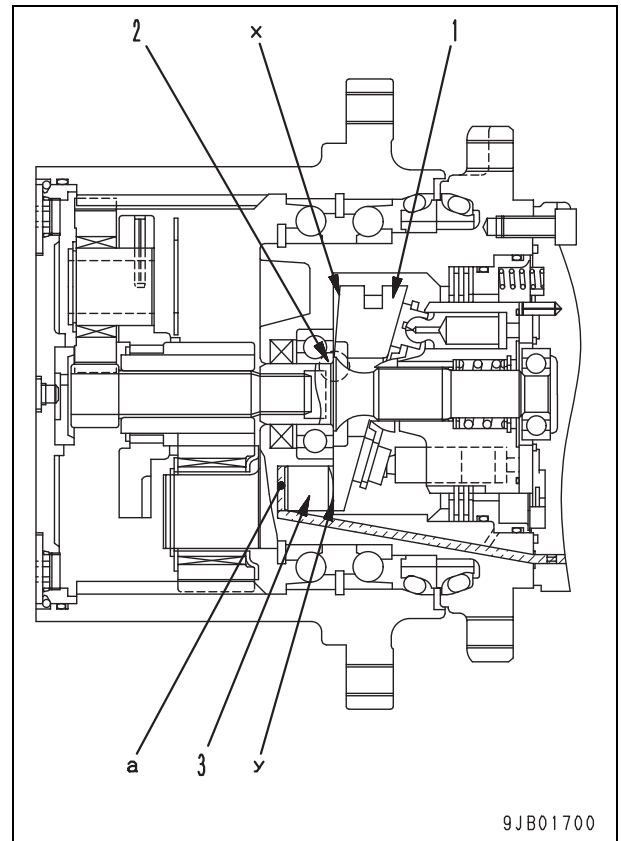
Type		PHV-350
Theoretical delivery (cm ³ /rev)	Hi	11.7
	Lo	22.1
Rated speed (rpm)	Hi	3,225
	Lo	1,707
Brake cracking pressure (MPa {kg/cm ² })		2.0 {20}
Speed changing pressure (MPa {kg/cm ² })		3.4 {35}
Automatic speed changing pressure (MPa {kg/cm ² })	Hi → Lo	21.3 {217}
	Lo → Hi	19.8 {202}
Reduction ratio		45.2



- | | |
|-------------------------|------------------------------------|
| 1. Oil filler plug | 14. Disc |
| 2. Cover | 15. Shaft |
| 3. No. 2 planetary gear | 16. Swash plate |
| 4. No. 2 sun gear | 17. Control piston |
| 5. Ring gear | 18. No. 1 planetary gear |
| 6. Ball | 19. No. 1 sun gear |
| 7. Housing | 20. No. 2 planetary carrier |
| 8. Piston | 21. Drain plug |
| 9. Cylinder | 22. Oil level plug |
| 10. Valve plate | 23. Check valve |
| 11. Brake valve | 24. Counterbalance valve |
| 12. Brake piston | 25. Check valve |
| 13. Plate | 26. Automatic speed changing valve |

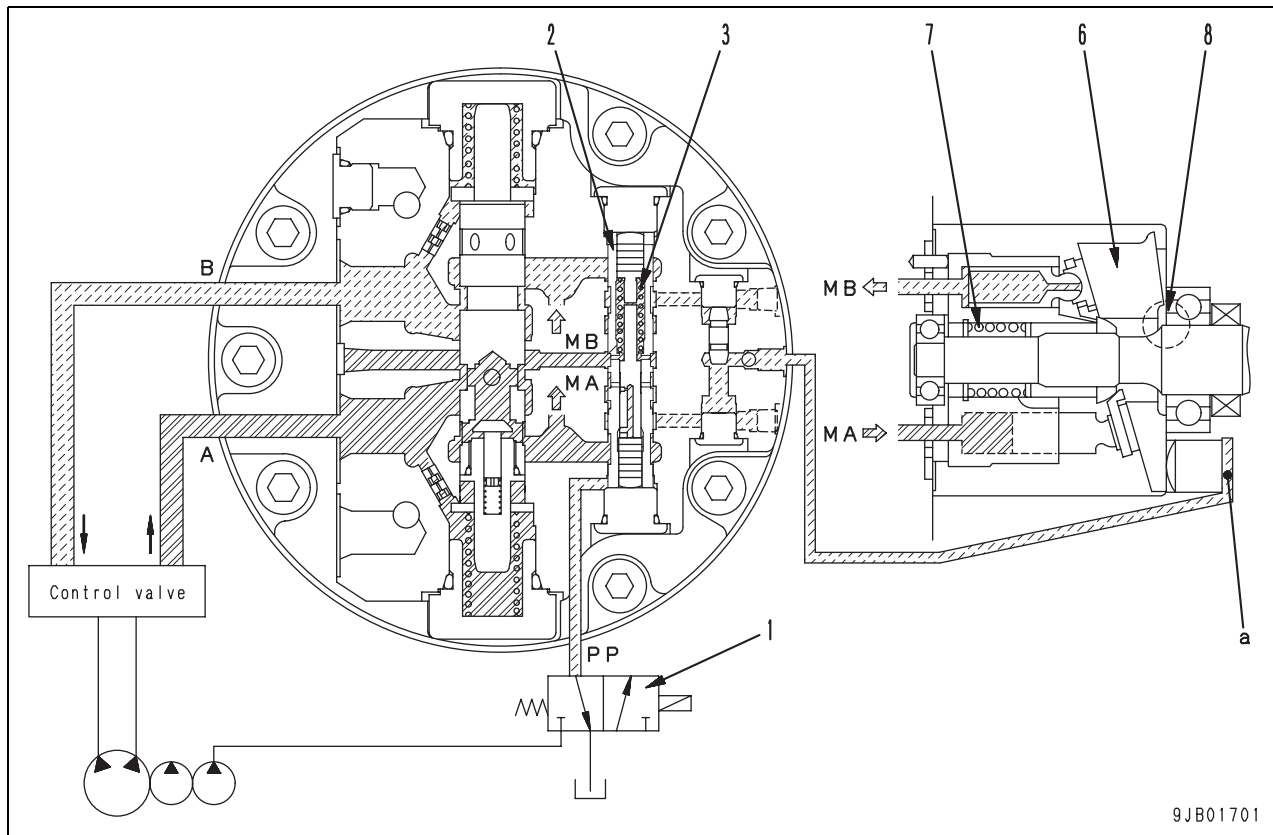
Outline

- Swash plate (1) has two rear faces (x) and (y), and is supported by ball (2).
- The travel speed is switched by pressurized oil from control chamber (a) acting on control piston (3). This switches the angle of swash plate (1) between the maximum angle and minimum angle to determine the travel speed.



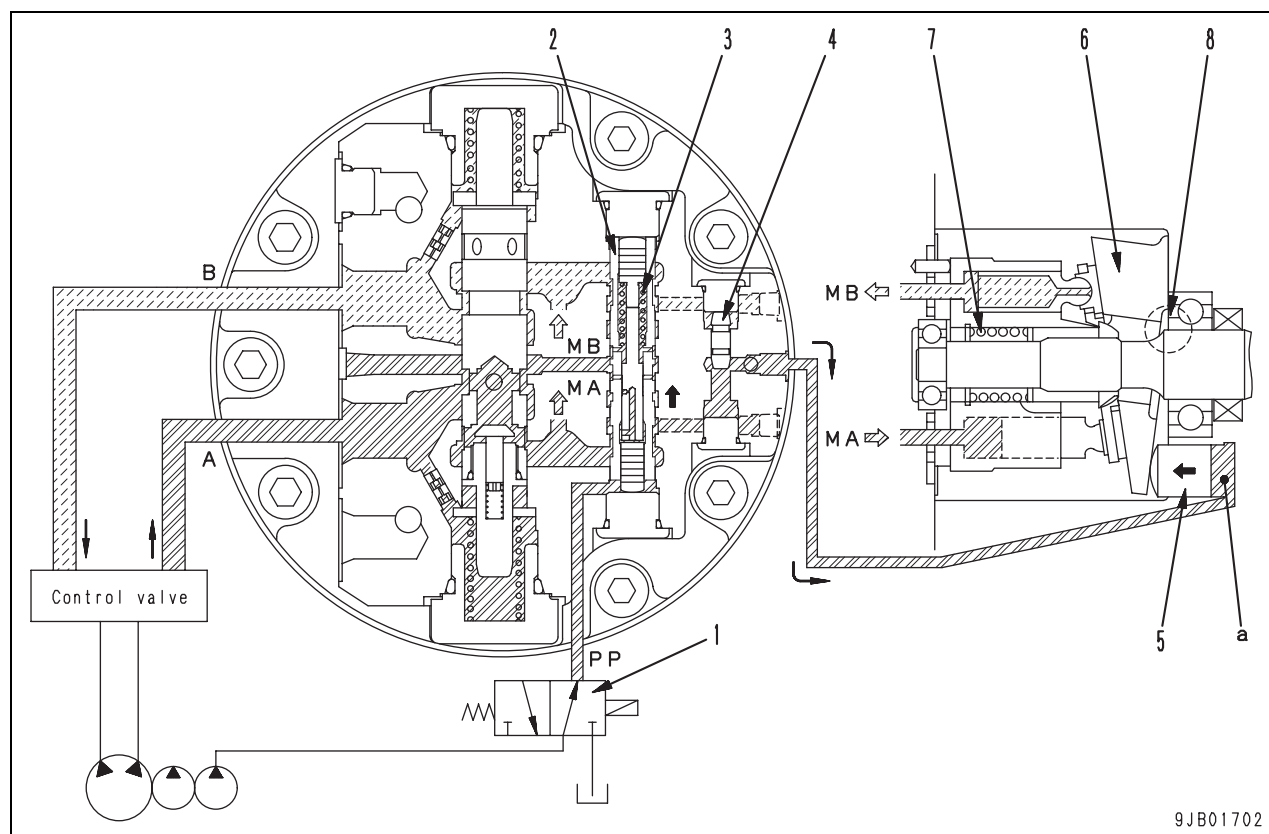
Operation of motor

At low speed (When motor swash plate angle is at maximum)



- Since 2nd travel speed selector solenoid valve (1) is turned OFF, the hydraulic oil from the control pump does not flow to port (PP).
- Since automatic speed changing valve (2) is pressed down by spring (3), the circuit to control chamber (a) is shut off.
- Since control chamber (a) is connected to the drain port, swash plate (6) is pressed to the right by the reaction force of center spring (7).
- Accordingly, swash plate (6) leans around ball (8) toward the maximum swash plate angle side and the motor capacity becomes maximum and the travel speed decreases.

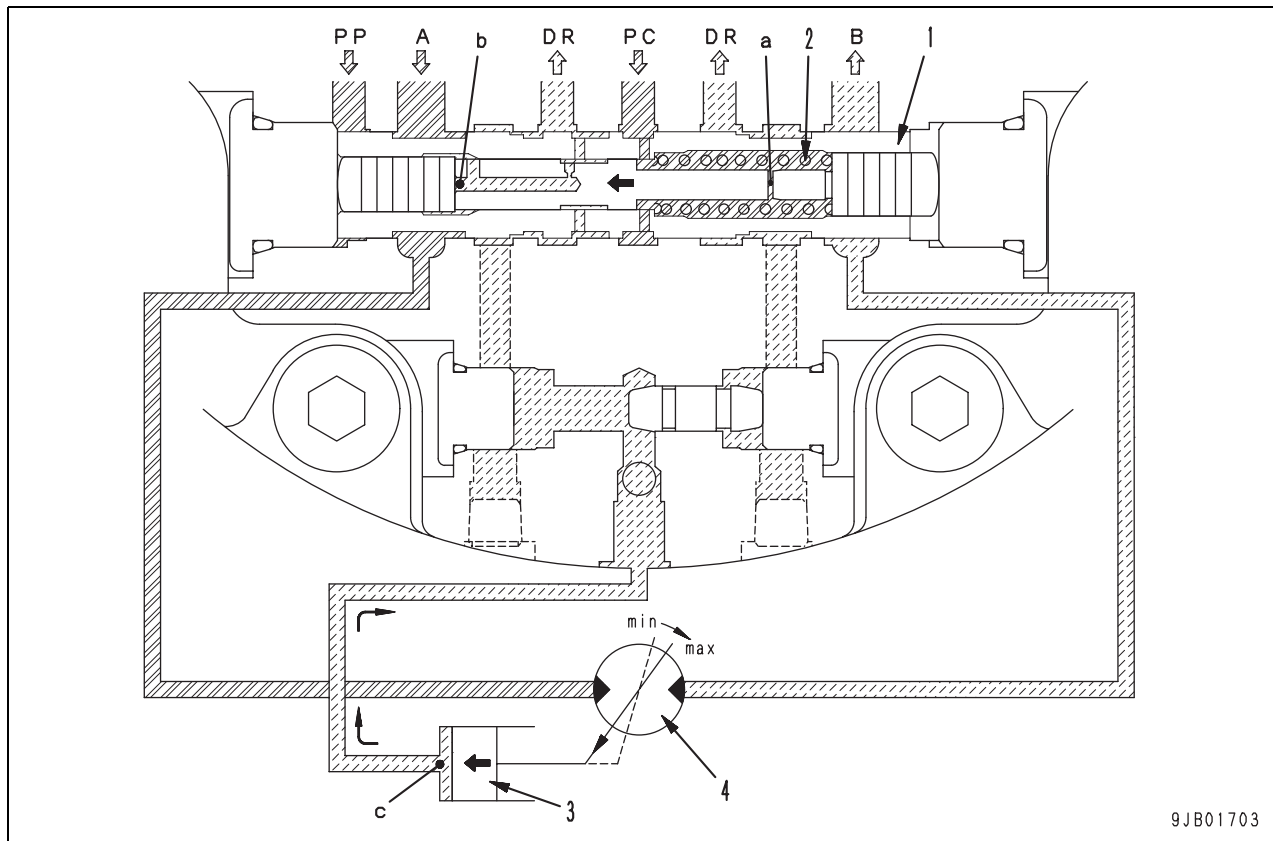
At high speed (When motor swash plate angle is at minimum)



- When 2nd travel speed selector solenoid valve (1) is turned ON, the pilot pressure from the control pump flows to port (PP).
 - Automatic speed changing valve (2) compresses spring (3) and moves up to open the circuit to control chamber (a).
 - The main hydraulic oil from the control valve flows from automatic speed changing valve (2) through check valve (4) to control chamber (a) to press control piston (5) to the left.
 - Accordingly, swash plate (6) leans around ball (8) against center spring (7) toward the minimum swash plate angle side and the motor capacity becomes minimum and the travel speed increases.
- ★ The automatic travel speed changing function works only while the travel speed selector switch is set in the high speed position. See "Automatic speed changing valve".
 - ★ While the arm crane (if equipped) is used, the travel speed is kept low.

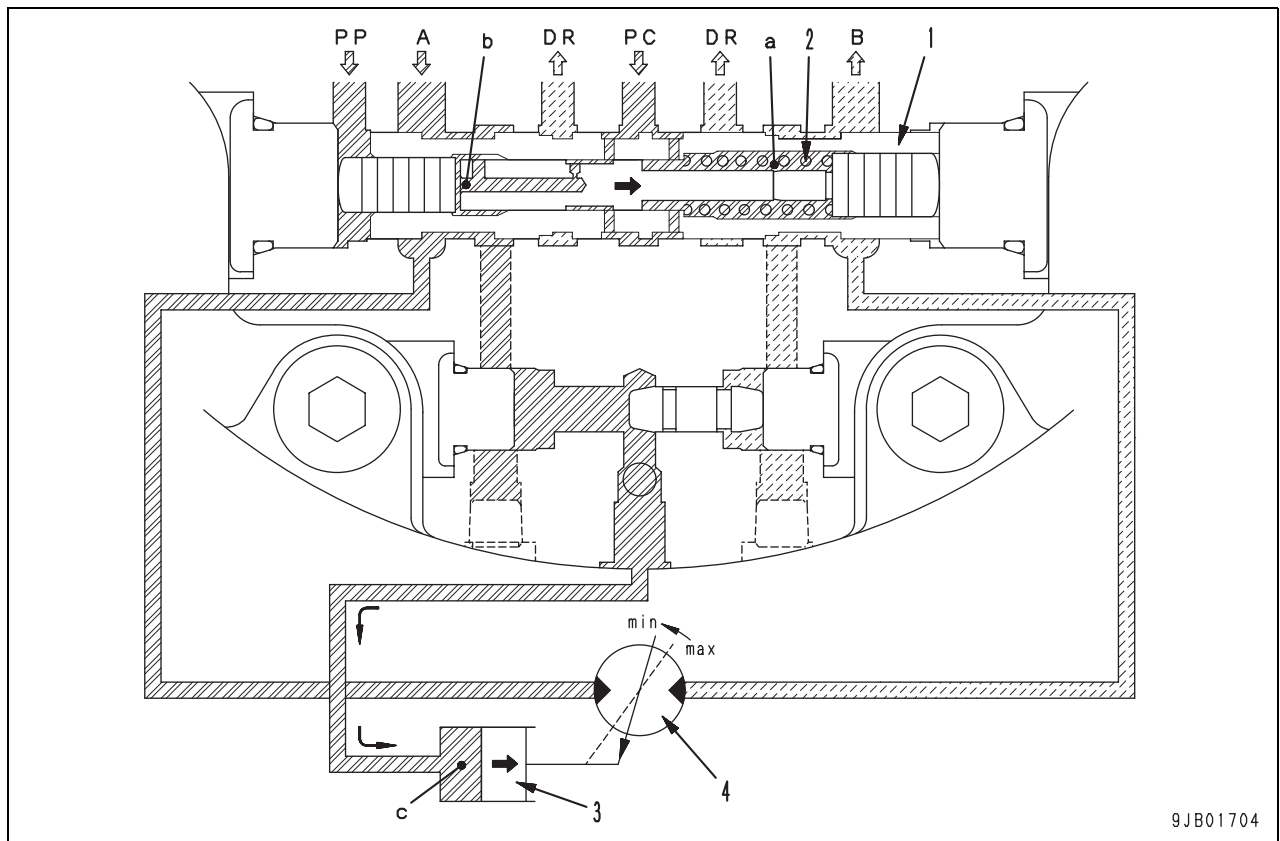
Operation of automatic speed changing valve

Automatic change of travel speed from high speed (High) to low speed (Low)



- While the travel speed selector switch is set in the high speed position, motor drive pressure (PC) is led into chambers (a) and (b) of automatic speed changing valve (1).
- If motor drive pressure (PC) rises, the total of force (F1) generated by the difference of the pressure receiving area between chambers (a) and (b) ($a > b$) and reaction force (F2) of spring (2) becomes larger than force (F3) generated by pilot pressure (PP).
($F3 < F1 + F2$)
- As a result, automatic speed changing valve (1) moves to the left and shuts off motor drive pressure (A) flowing into control chamber (c).
- At the same time, port (DR) opens and the oil in control chamber (c) is drained and control piston (3) moves to the left.
- Accordingly, the swash plate of motor (4) leans toward the maximum swash plate angle side and the travel speed decreases.

Automatic change of travel speed from low speed (Low) to high speed (High)



9JB01704

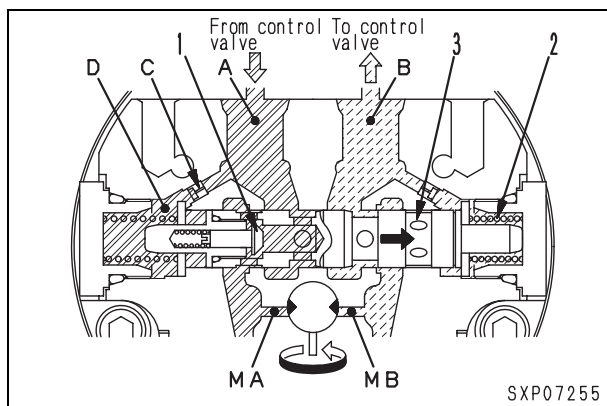
- If the machine travels at low speed while the travel speed selector switch is set in the high speed position, the motor drive pressure (PC) is led to chamber (a) of automatic speed changing valve (1). (Chamber (b) is connected to port (DR).)
- If the motor drive pressure (PC) lowers, the total of force (F1) generated in chamber (a) by the motor drive pressure (PC) and spring tension (F2) becomes less than force (F3) generated by the pilot pressure (PP).
($F3 > F1 + F2$)
- As a result, automatic speed changing valve (1) moves to the right and motor drive pressure (A) flows into control chamber (c).
- At the same time, port (DR) closes and control chamber (c) is filled with oil and control piston (3) moves to the right.
- Accordingly, the swash plate of motor (4) leans toward the minimum swash plate angle side and the travel speed increases.

Operation of counterbalance valve

Operation when pressure oil is supplied

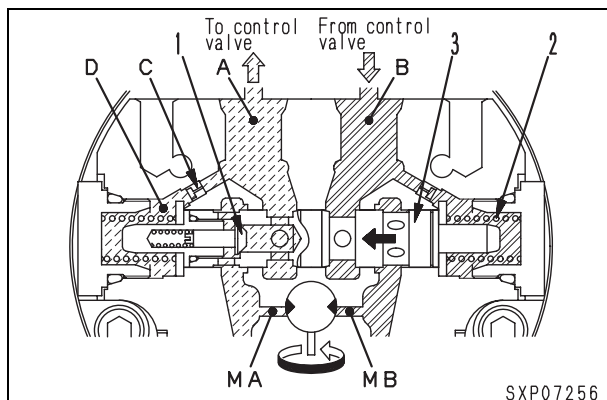
- When the travel lever is operated, the pressurized oil from the control valve is supplied to port (A). It pushes open check valve (1) and flows from motor inlet port (MA) to motor outlet port (MB).
- The pressurized oil at the supply side flows from orifice (C) to chamber (D). When the pressure in chamber (D) goes above the spring (2), spool (3) is pushed to the right direction.

As a result, port (MB) and port (B) are connected, the outlet port side of the motor is opened, and the motor starts to rotate.



Operation when pressure oil is shut off

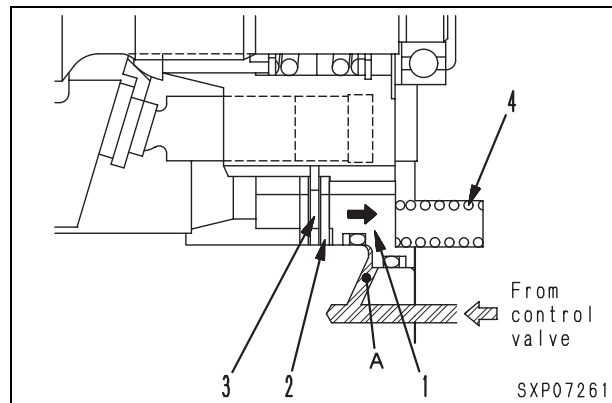
- If the travel lever is returned to the neutral position, the pressure oil from the control valve is shut off and spool (3) is pushed back to the left by the force of spring (2).
- At this time, the oil flows in port (A) through orifice (C) in chamber (D). The throttle effect of orifice (C) generates back pressure to restrict the speed of spool (3) returning to the left.
- Even if the pressure oil flowing in port (A) is shut off, the motor continues revolution because of its inertia.
- At this time, the changing speed of spool (3) and the shape of the cut reduce the returning oil gradually to stop the motor smoothly.



Operation of parking brake

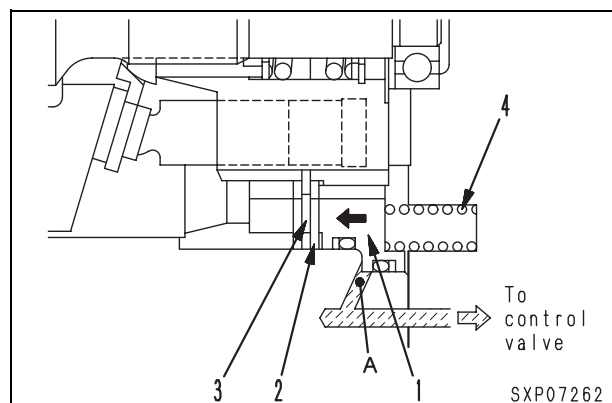
When travel lever is operated

- If the travel lever is operated, the hydraulic oil from the pump flows in chamber (A) of brake piston (1) and pushes brake piston (2) to the right. As a result, the pressing force of spring (4) against plate (2) and disc (3) is lost, and then plate (2) and disc (3) are separated and the braking force is released.



When travel lever is in neutral

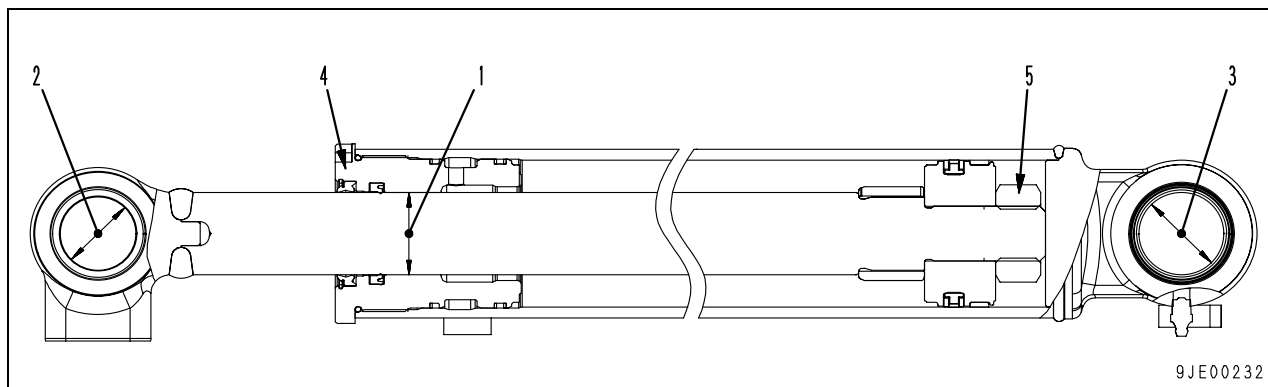
- If the travel lever is set in neutral, the hydraulic oil in chamber (A) of brake piston (1) is shut off and piston (1) is pressed to the left by spring (4). As a result, plate (2) and disc (3) are pressed and the brake operates.



Hydraulic cylinder

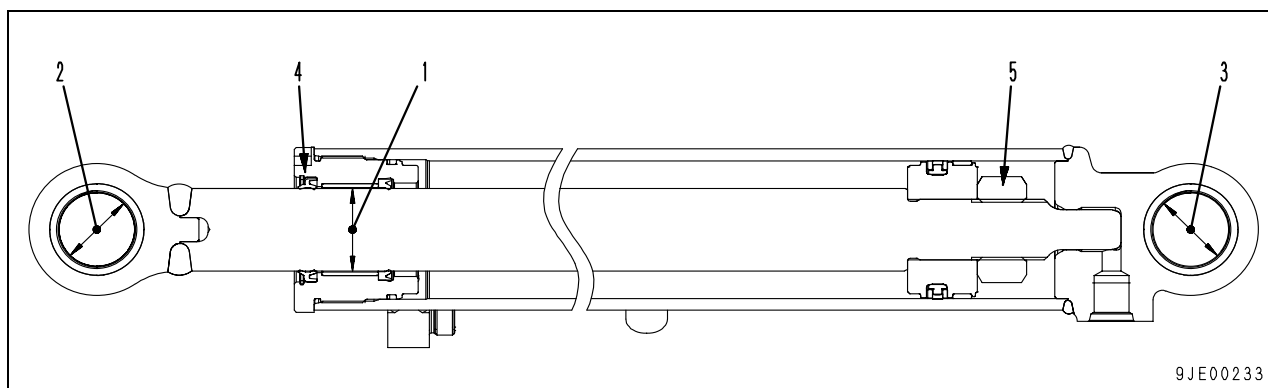
Boom cylinder

★ This diagram shows PC35MR.



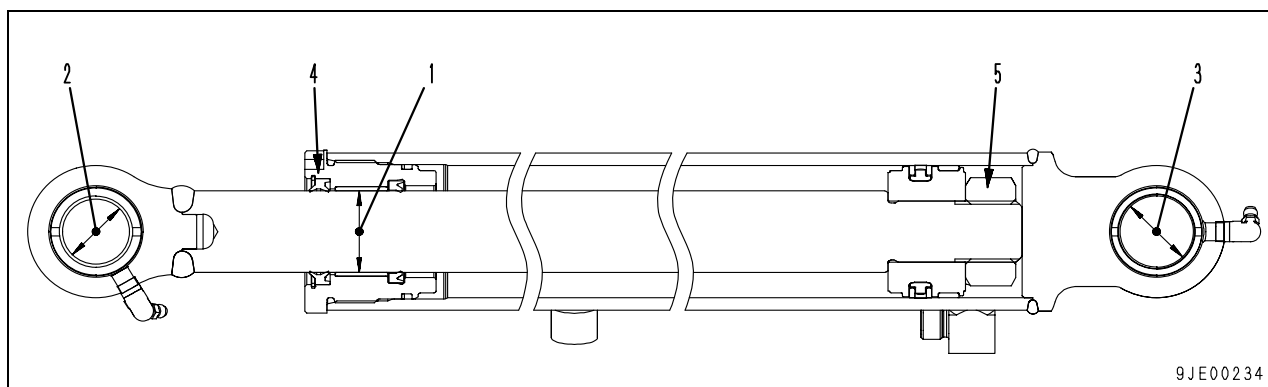
Arm cylinder

★ This diagram shows PC35MR.



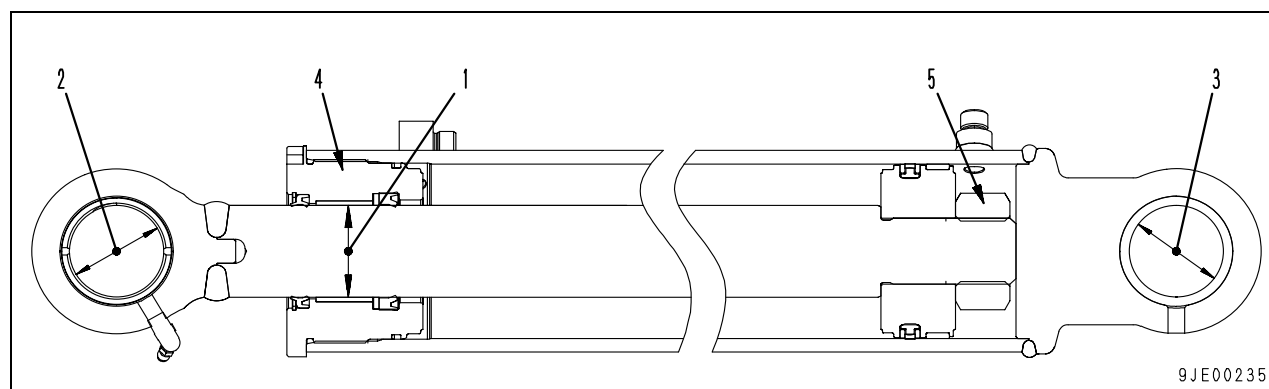
Bucket cylinder

★ This diagram shows PC35MR.

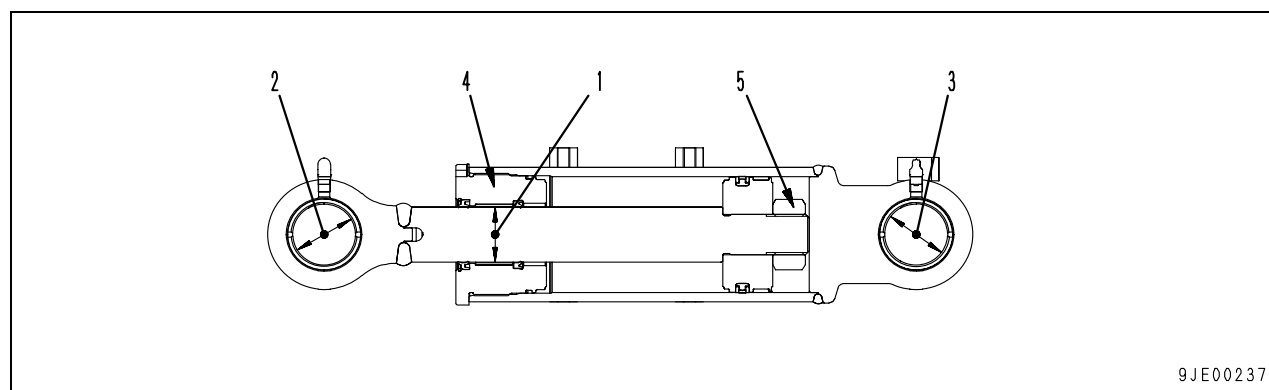


Boom swing cylinder

★ This diagram shows PC35MR.

**Blade cylinder**

★ This diagram shows PC35MR.



PC27MR-3

Unit: mm

No.	Check item		Criteria					Remedy
1	Clearance between piston rod and bushing	Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	Replace cylinder head
		Shaft		Hole				
		Boom	45	- 0.025 - 0.064	+ 0.039 0	0.025 - 0.103	0.403	Replace bushing
		Arm	40	- 0.025 - 0.087	+ 0.132 0.006	0.031 - 0.219	0.519	
		Bucket	35	- 0.025 - 0.064	+ 0.121 - 0.005	0.020 - 0.185	0.485	
		Boom swing	40	- 0.025 - 0.087	+ 0.132 + 0.006	0.031 - 0.219	0.519	
Blade	45	- 0.025 - 0.087	+ 0.152 + 0.007	0.032 - 0.239	0.539			
2	Clearance between piston rod supporting shaft and bushing	Boom	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	Replace pin and bushing
		Arm	35	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.170 - 0.230	0 - 0.060	0.110 - 0.230	1.0	
		Boom swing	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Blade	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	Retighten
		Arm	35	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.025 - 0.087	+ 0.142 + 0.080	0.105 - 0.229	1.0	
		Boom swing	40	- 0.025 - 0.064	+ 0.134 + 0.072	0.097 - 0.198	1.0	
		Blade	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
4	Tightening torque of cylinder head	Boom	569 ± 57.0 Nm {58 ± 5.8 kgm}					Retighten
		Arm	833 ± 83 Nm {85 ± 8.5 kgm}					
		Bucket	567 ± 57 Nm {58 ± 5.8 kgm}					
		Boom swing	676.9 ± 67.7 Nm {69 ± 6.9 kgm}					
		Blade	637 ± 63.5 Nm {65 ± 6.5 kgm}					
5	Tightening torque of cylinder piston	Boom	912 ± 91.0 Nm {93 ± 9.3 kgm}					Retighten
		Arm	912 ± 91 Nm {93 ± 9.3 kgm}					
		Bucket	618 ± 62 Nm {63 ± 6.3 kgm}					
		Boom swing	647 ± 64.5 Nm {66 ± 6.6 kgm}					
		Blade	1.08 ± 0.11 kNm {110 ± 11 kgm}					

PC30MR-3

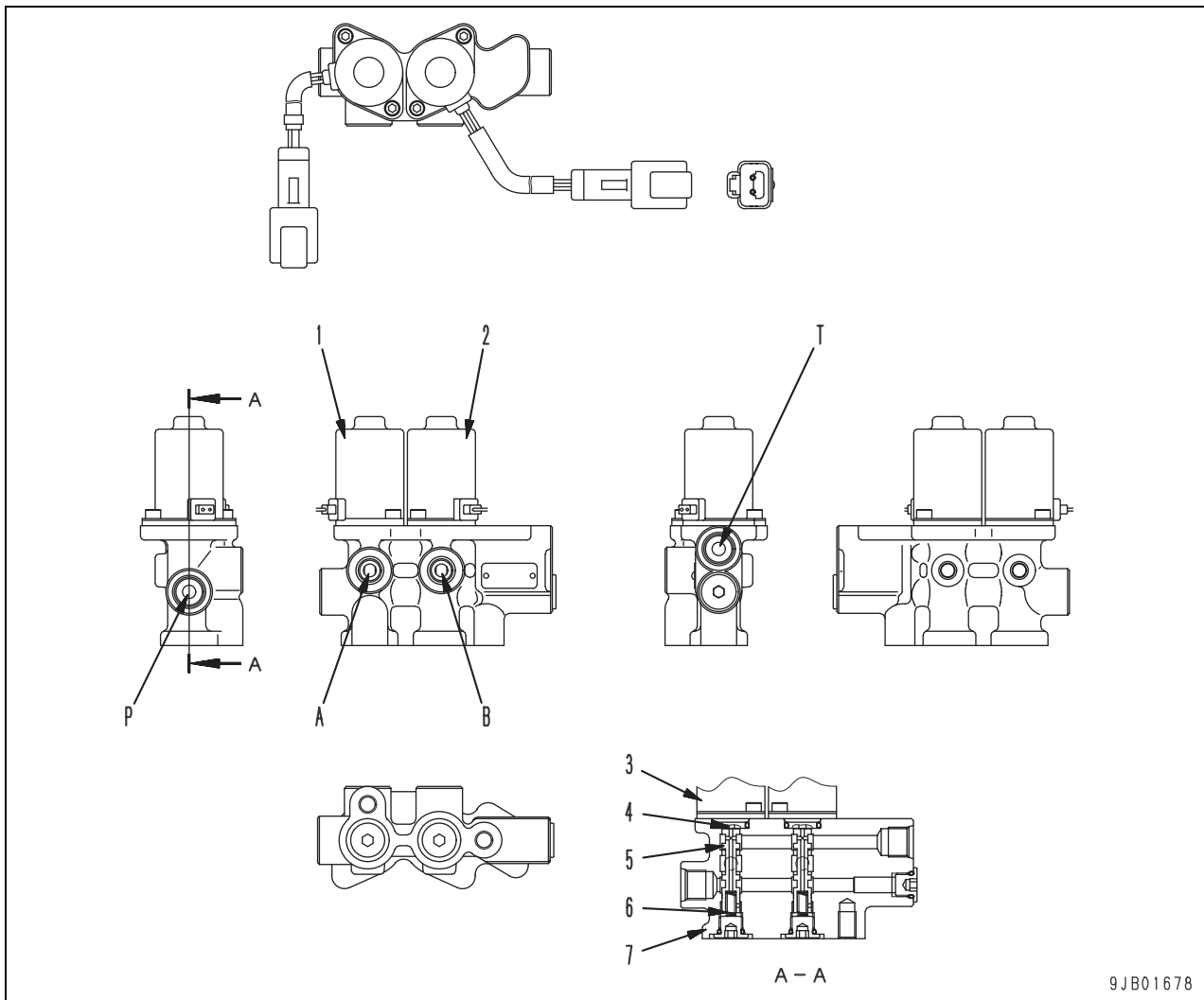
Unit: mm

No.	Check item		Criteria					Remedy
1	Clearance between piston rod and bushing	Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	Replace cylinder head
		Shaft		Hole				
		Boom	45	- 0.025 - 0.087	+ 0.039 0	0.025 - 0.126	0.426	Replace bushing
		Arm	45	- 0.025 - 0.064	+ 0.152 + 0.007	0.032 - 0.216	0.516	
		Bucket	40	- 0.025 - 0.087	+ 0.132 + 0.006	0.031 - 0.219	0.519	
		Boom swing	40	- 0.025 - 0.087	+ 0.132 + 0.006	0.031 - 0.219	0.551	
Blade	45	- 0.025 - 0.087	+ 0.152 + 0.007	0.032 - 0.239	0.539			
2	Clearance between piston rod supporting shaft and bushing	Boom	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	Replace pin and bushing
		Arm	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.170 - 0.230	0 - 0.060	0.110 - 0.230	1.0	
		Boom swing	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Blade	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Arm	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.025 - 0.087	+ 0.142 + 0.080	0.105 - 0.229	1.0	
		Boom swing	40	- 0.025 - 0.064	+ 0.134 + 0.072	0.097 - 0.198	1.0	
		Blade	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
4	Tightening torque of cylinder head	Boom	588 ± 59 Nm {60 ± 6.0 kgm}					Retighten
		Arm	788 ± 78.8 Nm {80 ± 8.0 kgm}					
		Bucket	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Boom swing	588 ± 59 Nm {60 ± 6.0 kgm}					
		Blade	637 ± 63.5 Nm {65 ± 6.5 kgm}					
5	Tightening torque of cylinder piston	Boom	912 ± 91.0 Nm {93 ± 9.3 kgm}					
		Arm	1.25 ± 0.13 kNm {127 ± 12.7 kgm}					
		Bucket	784 ± 78.4 Nm {80 ± 8.0 kgm}					
		Boom swing	647 ± 64.5 Nm {66 ± 6.6 kgm}					
		Blade	1.08 ± 0.11 kNm {110 ± 11 kgm}					

PC35MR-3

Unit: mm

No.	Check item		Criteria					Remedy
1	Clearance between piston rod and bushing	Cylinder name	Standard size	Tolerance		Standard clearance	Clearance limit	Replace cylinder head
				Shaft	Hole			
		Boom	45	- 0.025 - 0.087	+ 0.039 0	0.025 - 0.126	0.426	Replace bushing
		Arm	45	- 0.025 - 0.064	+ 0.152 + 0.007	0.032 - 0.216	0.516	
		Bucket	40	- 0.025 - 0.087	+ 0.132 + 0.006	0.031 - 0.219	0.519	
		Boom swing	50	- 0.025 - 0.064	+ 0.164 + 0.007	0.032 - 0.228	0.528	
Blade	45	- 0.025 - 0.087	+ 0.152 + 0.007	0.032 - 0.239	0.539			
2	Clearance between piston rod supporting shaft and bushing	Boom	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	Replace pin and bushing
		Arm	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.170 - 0.230	0 - 0.060	0.110 - 0.230	1.0	
		Boom swing	50	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Blade	50	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
3	Clearance between cylinder bottom supporting shaft and bushing	Boom	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Arm	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Bucket	35	- 0.025 - 0.087	+ 0.142 + 0.080	0.105 - 0.229	1.0	
		Boom swing	50	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
		Blade	50	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
4	Tightening torque of cylinder head	Boom	588 ± 59 Nm {60 ± 6.0 kgm}					Retighten
		Arm	785 ± 78 Nm {80 ± 8.0 kgm}					
		Bucket	677 ± 67.5 Nm {69 ± 6.9 kgm}					
		Boom swing	735 ± 73.5 Nm {75 ± 7.5 kgm}					
		Blade	735 ± 73.5 Nm {75 ± 7.5 kgm}					
5	Tightening torque of cylinder piston	Boom	912 ± 91.0 Nm {93 ± 9.3 kgm}					
		Arm	1.25 ± 0.13 kNm {127 ± 12.7 kgm}					
		Bucket	784 ± 78.4 Nm {80 ± 8.0 kgm}					
		Boom swing	1.42 ± 0.14 kNm {145 ± 14.5 kgm}					
		Blade	1.08 ± 0.11 kNm {110 ± 11.0 kgm}					

Solenoid valve**2-spool solenoid valve****PC27MR, 30MR-3**

9JB01678

A : To PPC valve
 B : To 2nd travel speed selector valve
 P : From hydraulic pump
 T : To hydraulic tank

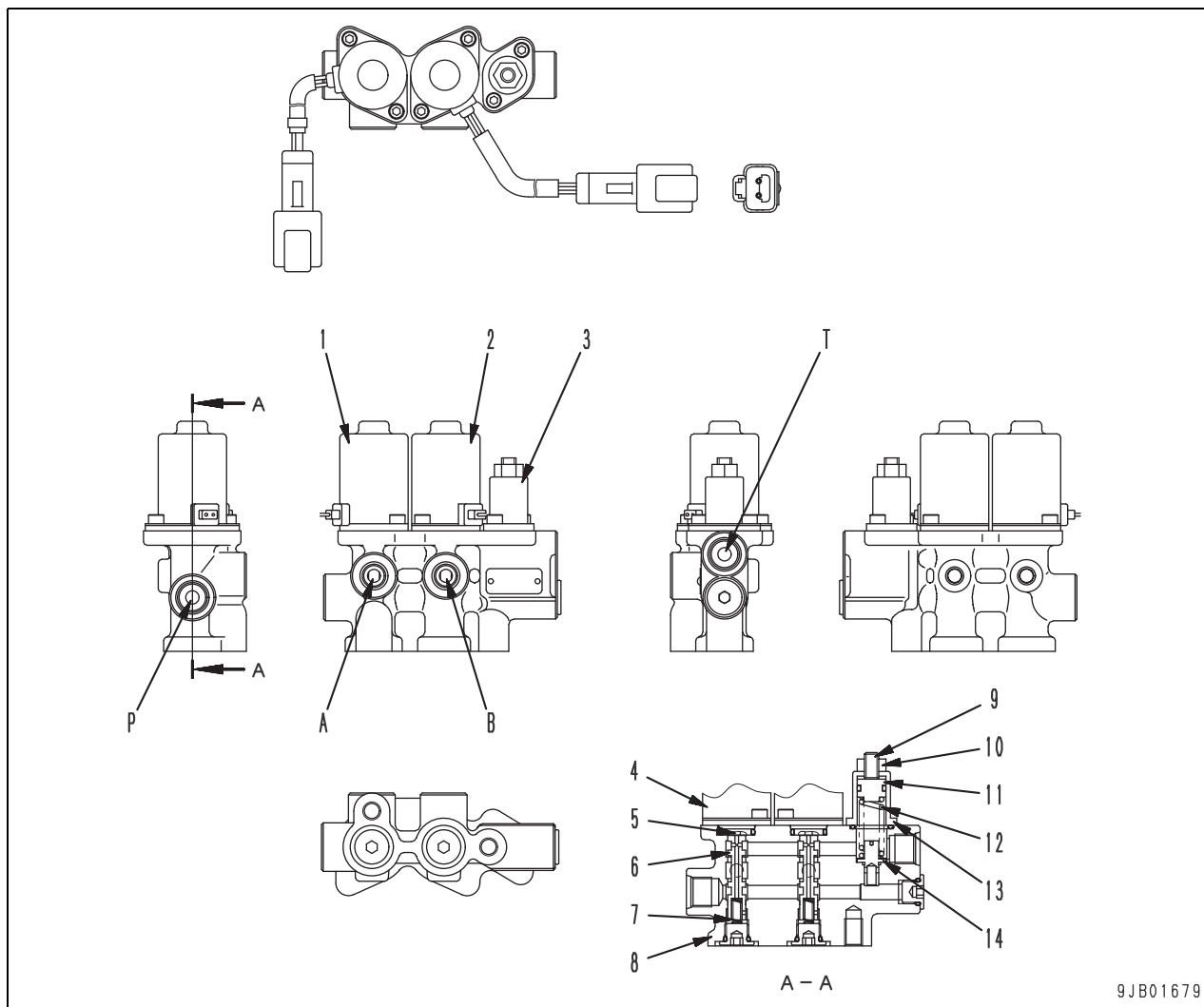
1. PPC lock solenoid valve
2. 2nd travel speed selector solenoid valve

Solenoid valve

3. Coil (ON/OFF type)
4. Push pin
5. Valve spool
6. Return spring
7. Valve body

2-spool solenoid valve

PC35MR-3



- A : To PPC valve
B : To 2nd travel speed selector valve
P : From hydraulic pump
T : To hydraulic tank

1. PPC lock solenoid valve
2. 2nd travel speed selector solenoid valve
3. Control relief valve

Solenoid valve

4. Coil (ON/OFF type)
5. Push pin
6. Valve spool
7. Return spring
8. Valve body

Control relief valve

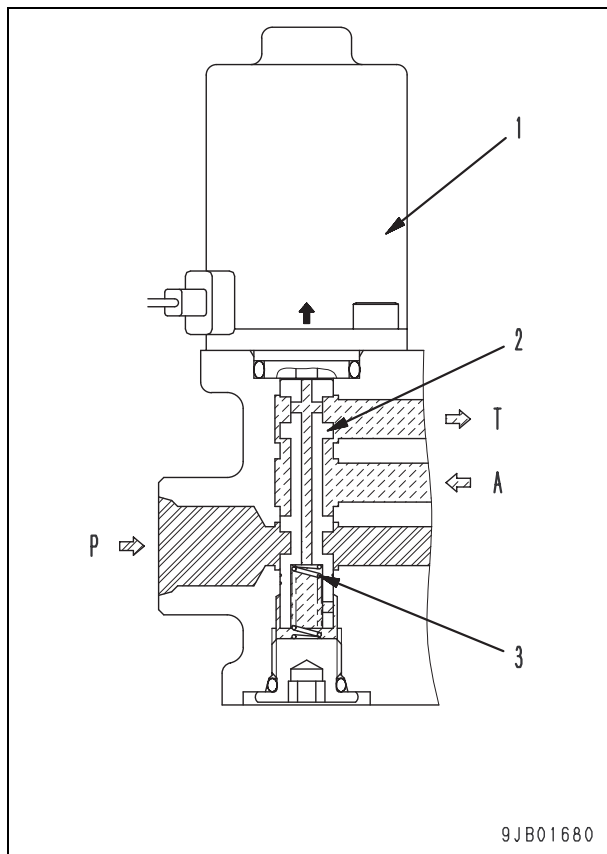
9. Adjustment screw
10. Locknut
11. Plug
12. Return spring
13. Cover
14. Plunger

2nd travel speed selector solenoid valve PPC lock solenoid valve

Operation

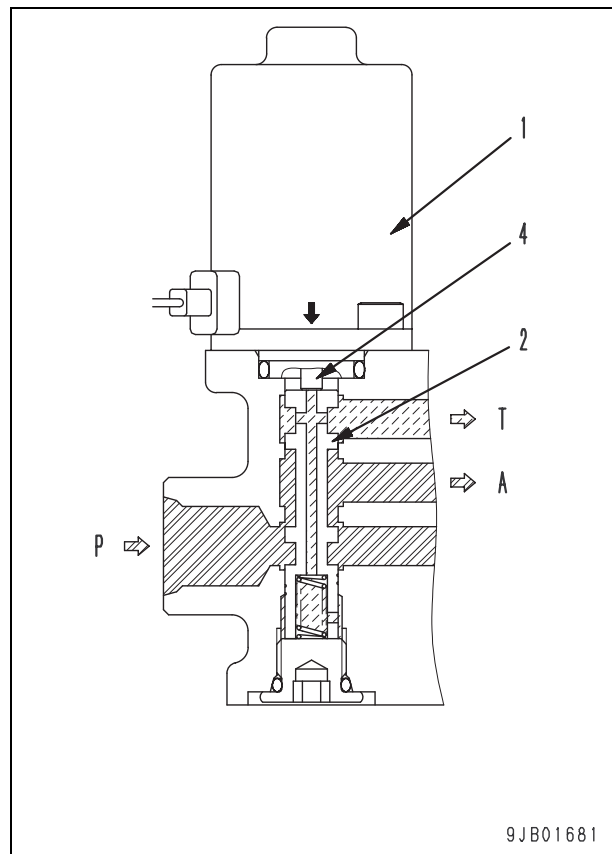
When solenoid is turned OFF (When circuit is shut off)

- While the signal current is not flowing from the PPC lock solenoid valve or travel speed selector switch, solenoid (1) is turned OFF. Accordingly, spool (2) is pressed up by spring (3).
- As a result, ports (P) and (A) are shut off from each other and the pilot pressure does not flow into the actuator. At the same time, the oil from the actuator flows through ports (A) and (T) to the hydraulic tank.



When solenoid is turned ON (When circuit is connected)

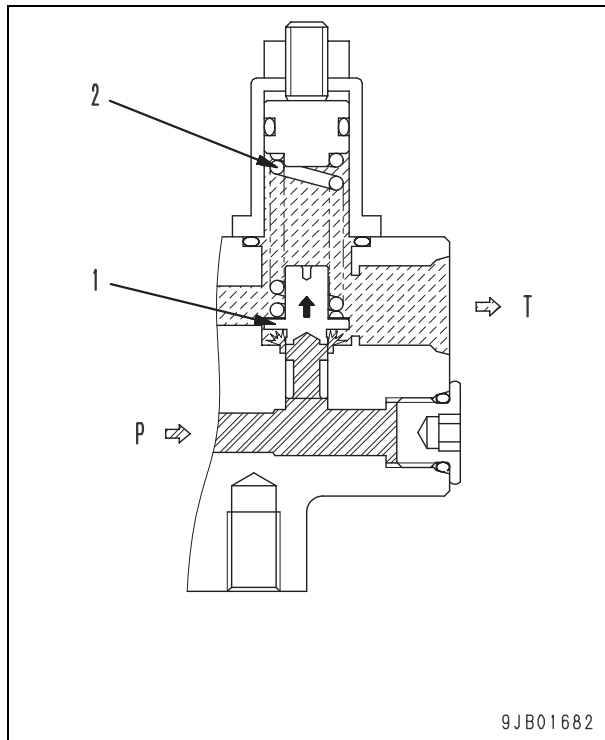
- While the signal current is flowing from the PPC lock solenoid valve or travel speed selector switch to solenoid (1), solenoid (1) is turned ON.
- Accordingly, spool (2) is pressed down by push pin (4).
- As a result, ports (P) and (A) are connected to each other and the pilot pressure flows into the actuator. At the same time, port (T) is closed and the oil does not flow to the hydraulic tank.



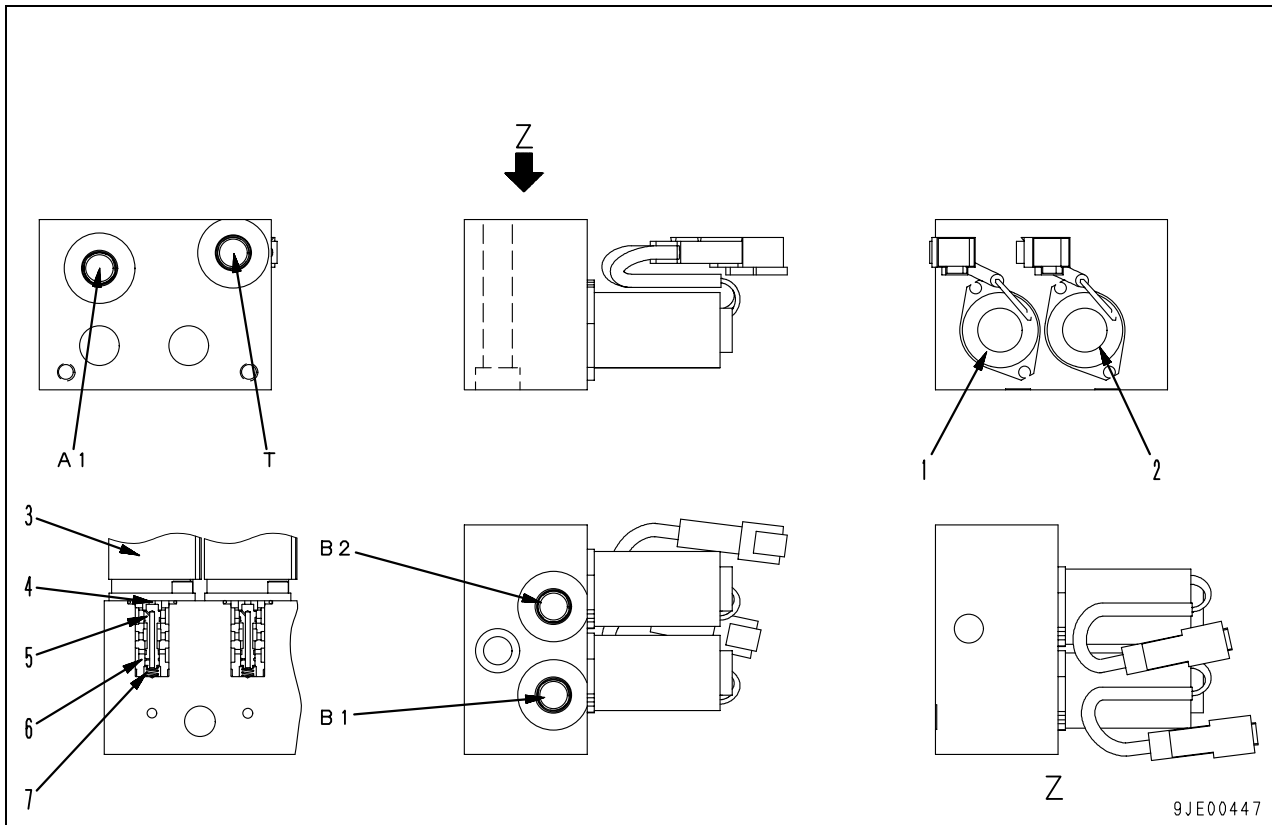
Control relief valve

Operation

- If the oil pressure from the hydraulic pump increases, the oil in port (P) pushes plunger (1) and its reaction force compresses spring (2) and moves up plunger (1), and then the oil is relieved through ports (P) and (T).
Set pressure: 3.14 MPa {32 kg/cm²}



2-spool EPC valve (Attachment switch specification)



A1: From 2-spool solenoid valve
 B1: To control valve (attachment port PB)
 B2: To control valve (attachment port PA)
 T: To hydraulic tank

1. Oil flow adjuster EPC valve for attachment (b)
2. Oil flow adjuster EPC valve for attachment (a)

EPC valve

3. Coil (proportional type)
4. Push pin
5. Valve spool
6. Guide
7. Return spring

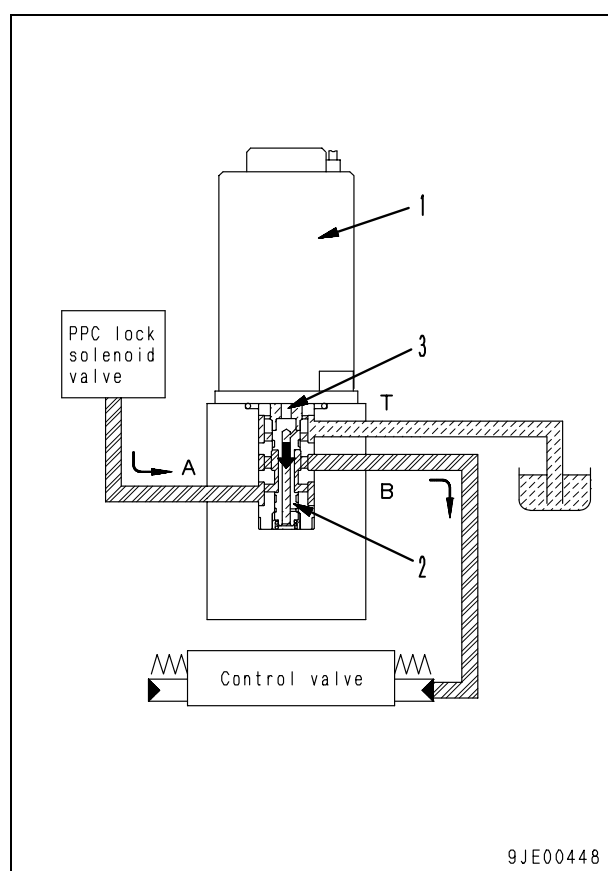
Attachment control EPC valve

Operation

When signal current is maximum

(When coil is energized and circuit pressure is maximum)

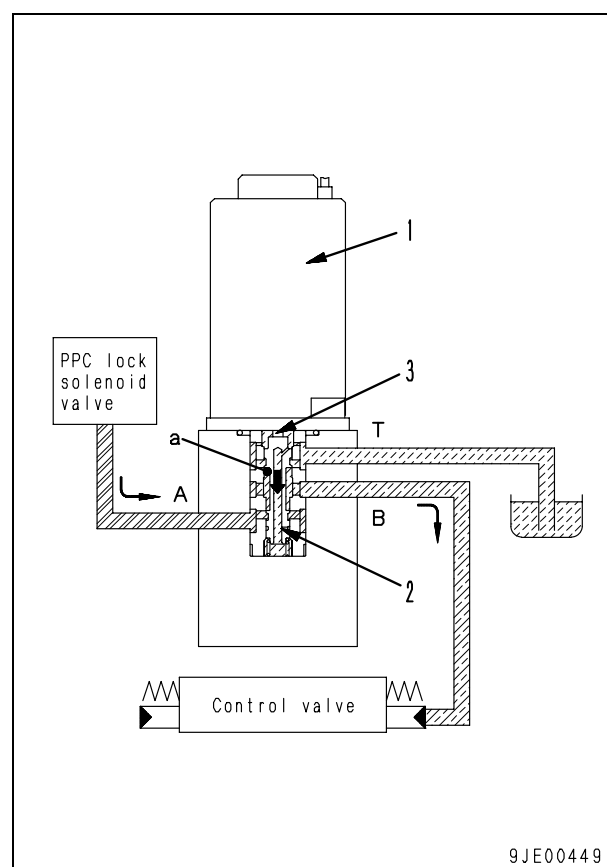
- If the signal current flows from the controller into coil (1), coil (1) is energized.
At this time, the thrust of coil (1) is maximum.
- As a result, spool (2) is pushed down by push pin (3).
- Accordingly, all the pressurized oil from the PPC lock solenoid valve flows through port (A), spool (2), and port (B) to the control valve.
At this time, port (T) is closed and no oil flows into the tank.



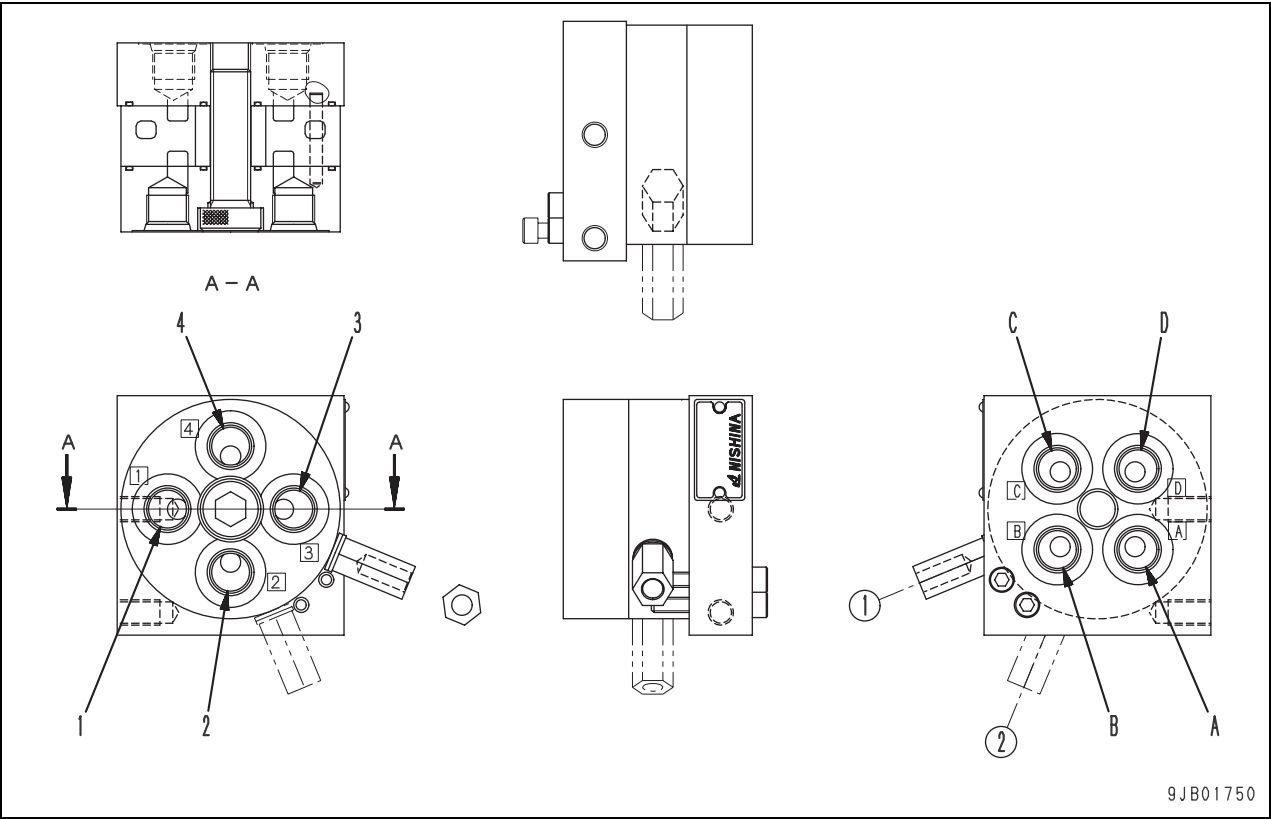
When signal current is reduced

(When coil is energized and circuit pressure is low)

- If the signal current flowing from the controller into coil (1) is reduced, coil (1) is still energized but its thrust is lowered in proportion to the signal current.
- As a result, push pin (3) pushes down spool (2) and the pressurized oil from port (A) flows to port (B).
- If the pressure in port (B) increases and the force applied to face "a" of spool (2) becomes larger than the thrust of coil (1), spool (2) is pushed up and port (A) is disconnected from port (B) and connected to port (T).
- Accordingly, spool (2) moves up and down so that the thrust of coil (1) will be balanced with the pressure in port (B).
- As a result, the circuit pressure between the PPC lock solenoid valve and control valve is controlled in proportion to the signal current.



Multi-control valve



- (1) JIS pattern
- (2) BACKHOE pattern

Operation pattern selection drawing (The port names correspond to the symbols in the drawing).

① JIS Pattern	② Backhoe Pattern
<div><div><div>Boom Raise</div><div>Arm In</div><div>Arm Out</div><div>Boom Lower</div></div><div><div>D</div><div>C</div><div>B</div><div>A</div></div><div><div>4 PPC left valve, Backward tilting</div><div>3 PPC right valve, Backward tilting</div><div>2 PPC right valve, Forward tilting</div><div>1 PPC left valve, Forward tilting</div></div></div>	<div><div><div>Boom Raise</div><div>Arm In</div><div>Arm Out</div><div>Boom Lower</div></div><div><div>D</div><div>C</div><div>B</div><div>A</div></div><div><div>4 PPC left valve, Backward tilting</div><div>3 PPC right valve, Backward tilting</div><div>2 PPC right valve, Forward tilting</div><div>1 PPC left valve, Forward tilting</div></div></div>

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04073-02

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

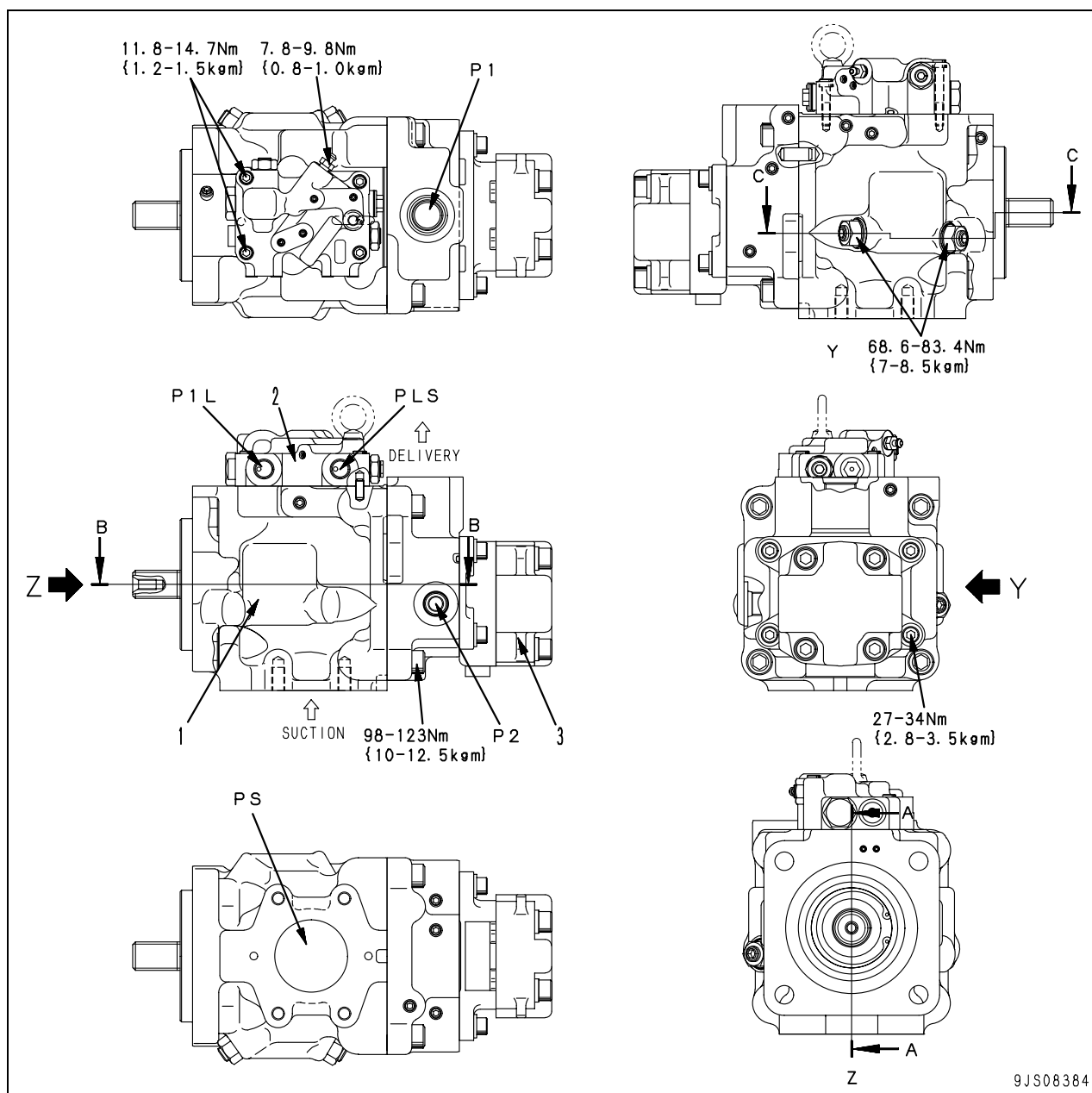
420 Hydraulic system, Part 2

Hydraulic pump	2
Control valve	18

Hydraulic pump

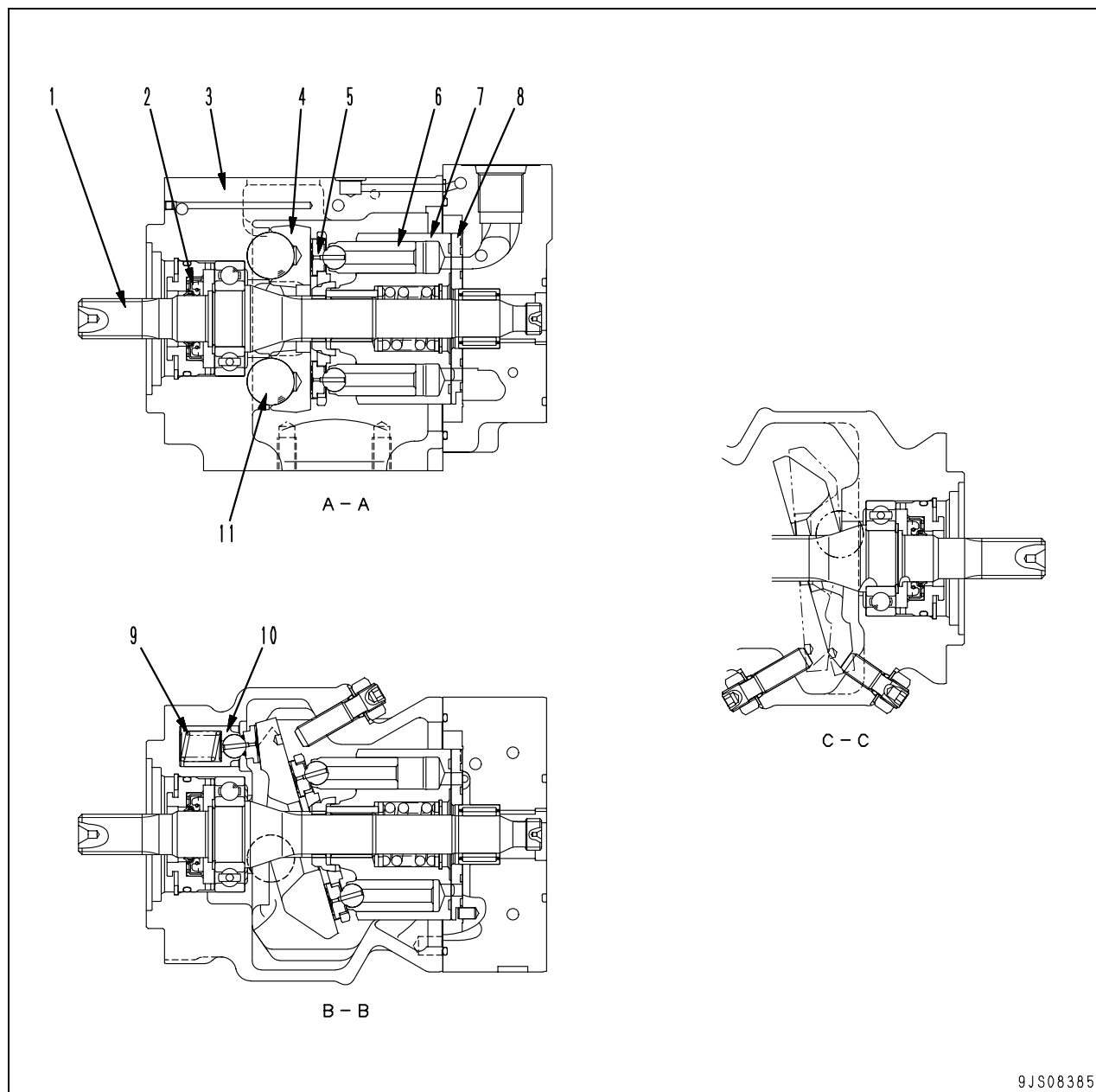
Type: LPV30 + SBR8.5
PC27MR, 30MR-3

Main pump

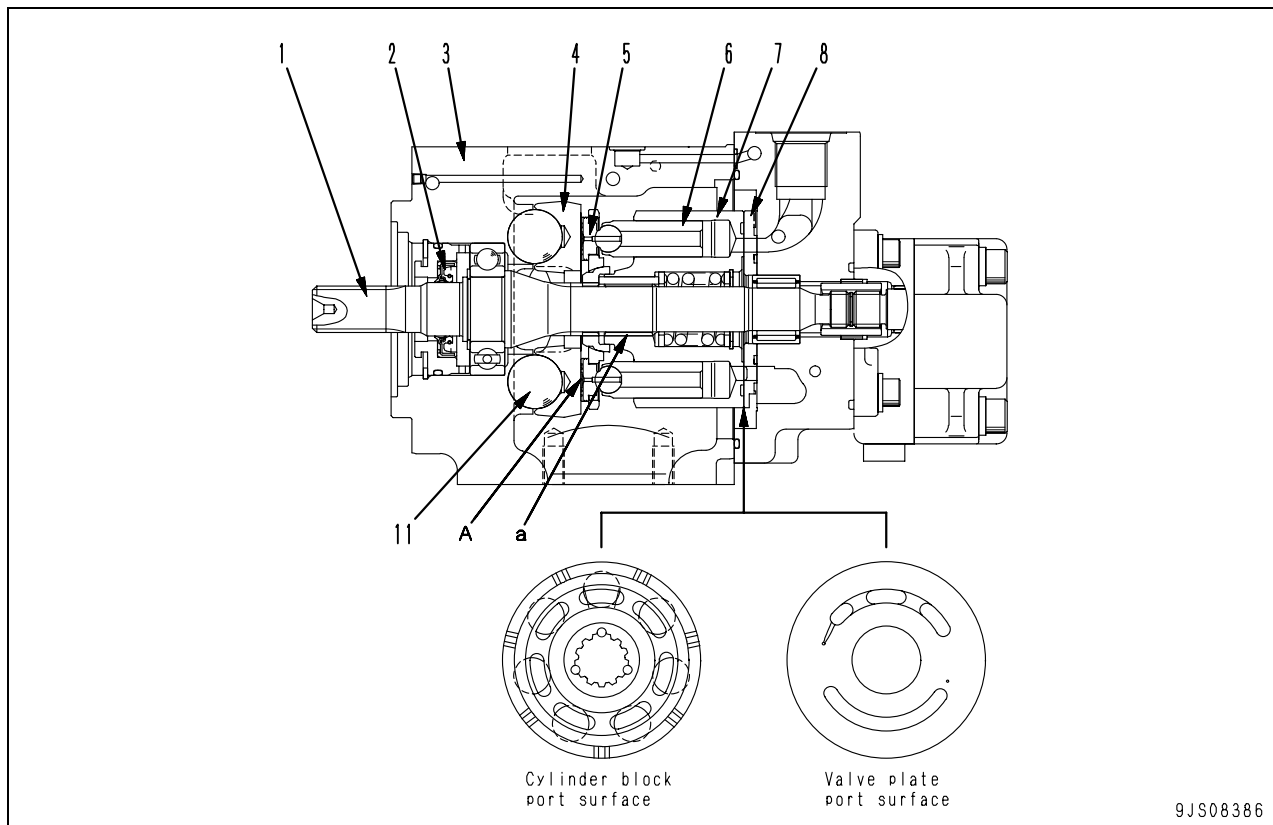


P1 : Pump discharge port
P1L : Pump pressure input port
P2 : Gear pump discharge port
PS : Pump suction port
PLS : LS pressure input port

1. Main pump (piston pump)
2. Servo valve
3. Gear pump



- | | |
|---------------|--------------------------------------|
| 1. Shaft | 7. Cylinder block |
| 2. Oil seal | 8. Valve plate |
| 3. Case | 9. Spring (In servo piston) |
| 4. Rocker cam | 10. Servo piston |
| 5. Shoe | 11. Ball (For supporting rocker cam) |
| 6. Piston | |



Function

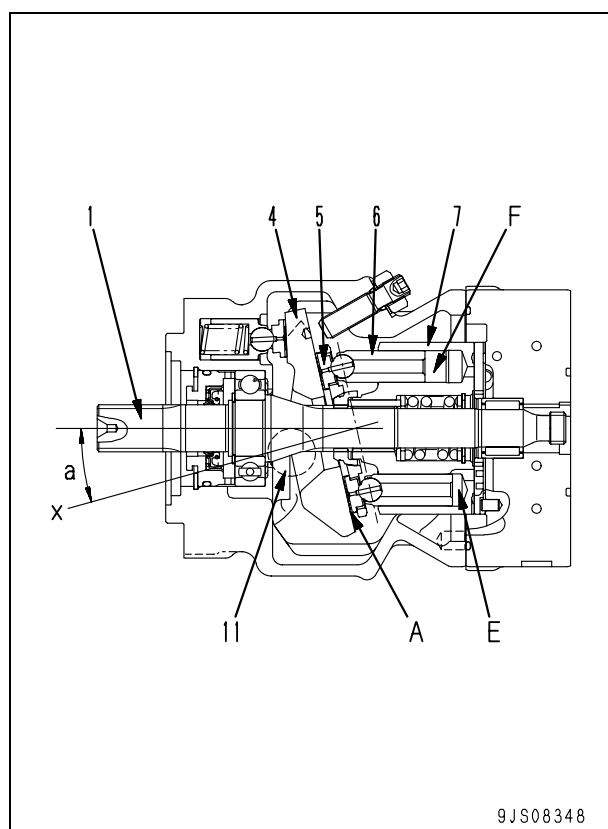
- The engine rotation and torque transmitted to the pump shaft is converted into hydraulic energy, and pressurized oil is discharged according to the load.
- It is possible to change the pump delivery by changing the swash plate angle.

Structure

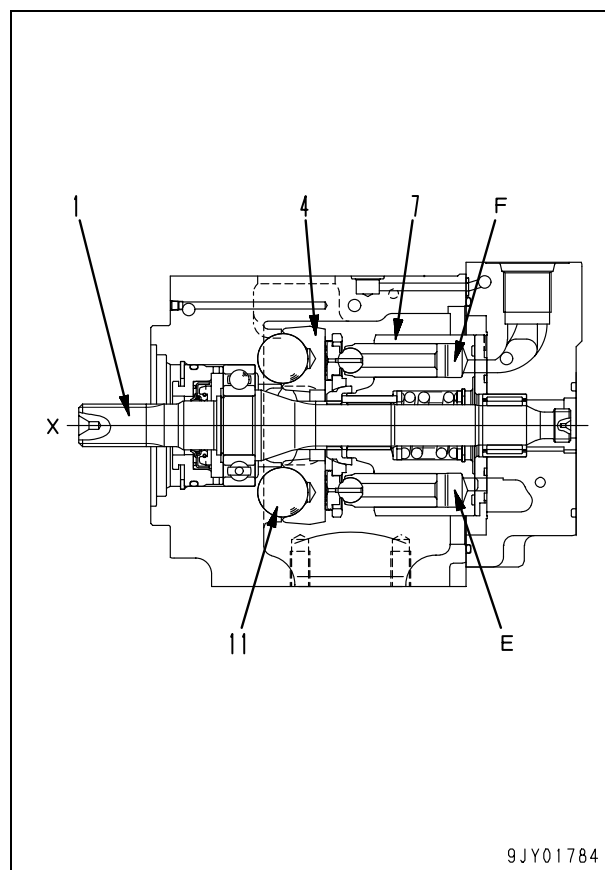
- Cylinder block (7) is supported to shaft (1) by spline (a), and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface (A). Shoe (5) is kept pressed against the flat surface (A) and it slides circularly on flat surface (A). Rocker cam (4) slides around ball (11).
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level. The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).
- Hole number of cylinder block (7) is an odd number. So, it is suited to groove of valve plate (8).

Operations

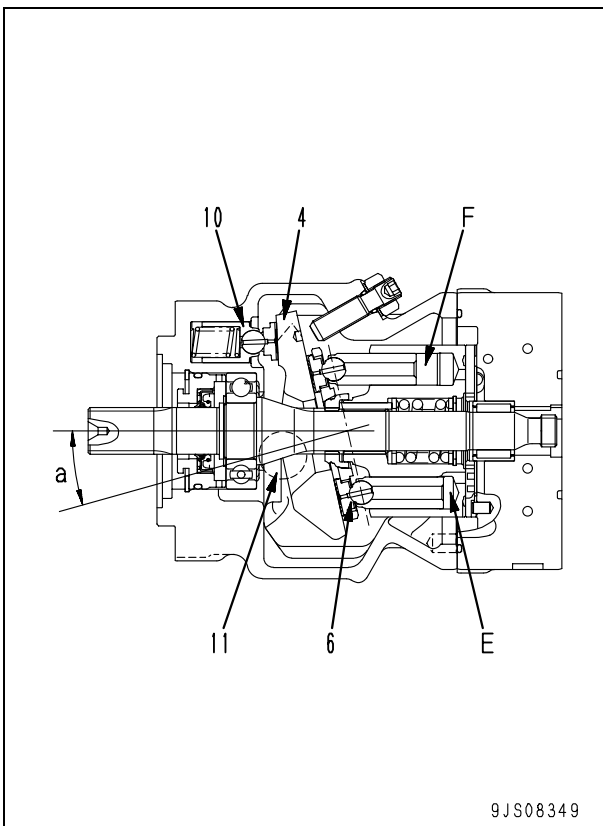
- Shaft (1) and cylinder block (7) rotate together and shoe (5) slides on the flat surface (A). Since the rocker cam (4) leans around ball (11) at this time, the angle (a) between the center line (X) of rocker cam (4) and axis of cylinder block (7) changes. The angle (a) is called the swash plate angle.
- When the center line (X) of the rocker cam (4) maintains the swash plate angle (a) in relation to the axial direction of the cylinder block (7), the flat surface (A) acts as a cam for the shoe (5).
- By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between capacities (E) and (F), then suction and discharge of oil for the amount of this difference (F) – (E) will be carried out.
- In other words, oil is discharged as the capacity of the chamber (E) decreases when the cylinder block (7) rotates.
In the meantime, the capacity of the chamber (F) increases, and the oil is sucked at this process.
(The figure shows the state of the pump when suction of the chamber (F) and discharge of the chamber (E) have completed.)



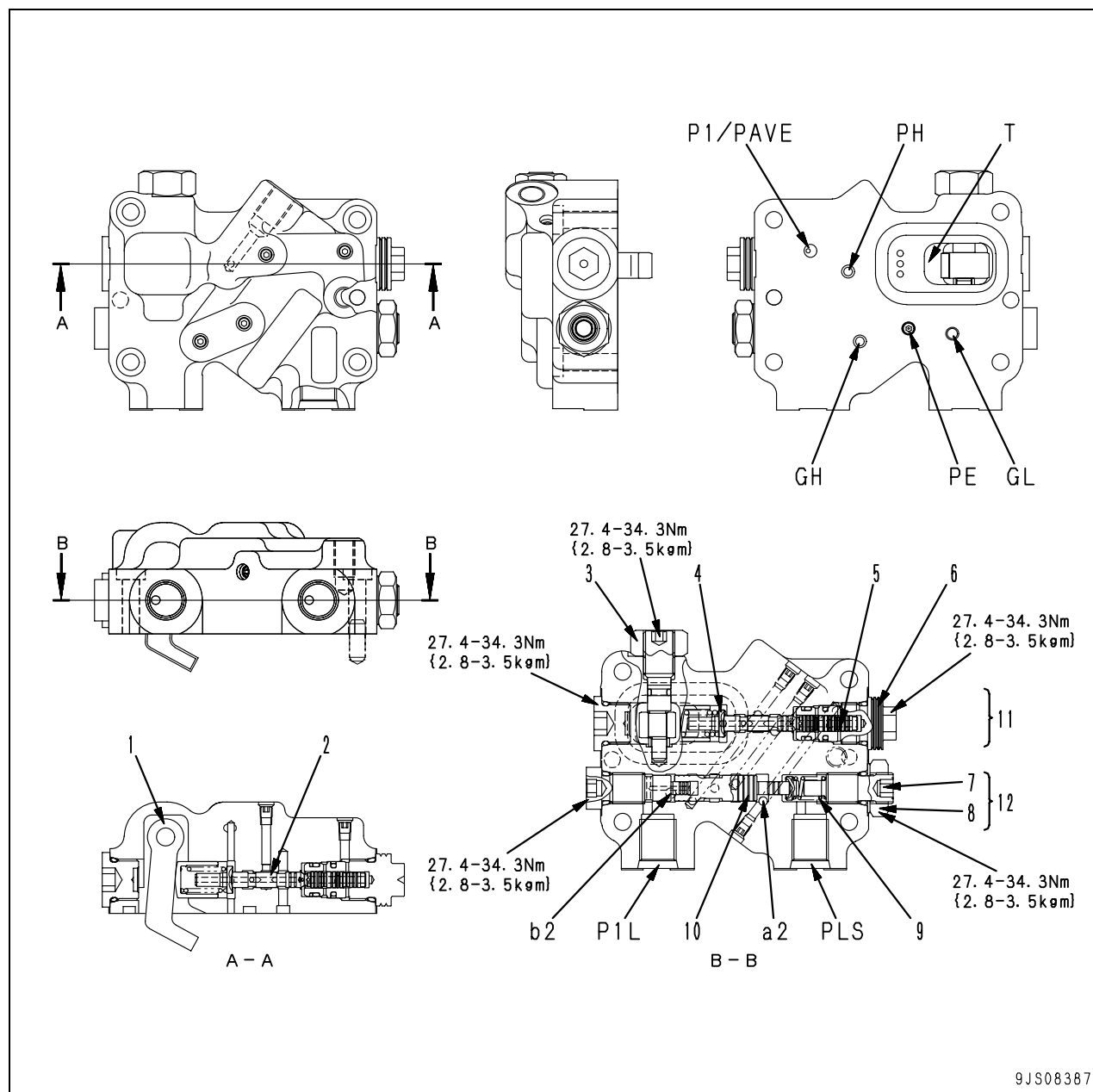
- When the center line (X) of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of (E) and (F) inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of oil. (In actual fact, the swash plate angle never becomes 0.)
- In other words, pump delivery is directly proportional to the swash plate angle (a).



- As the swash plate angle (a) becomes larger, difference between the capacities (E) and (F) becomes larger, so the pump delivery (Q) increases.
The swash plate angle (a) is changed by the servo piston (10).
- Servo piston (10) is reciprocated straight by the signal pressure of the PC and LS valves. This reciprocation is transferred to rocker cam (4). Rocker cam (4) supported on ball (11) rocks around ball (11).
- The output pressure of the LS valve is applied to the pressure chamber of servo piston (10).
- As output pressure rises, rocker cam (4) moves to reduce the swash plate angle (a), so the pump delivery (Q) decreases.



Servo valve

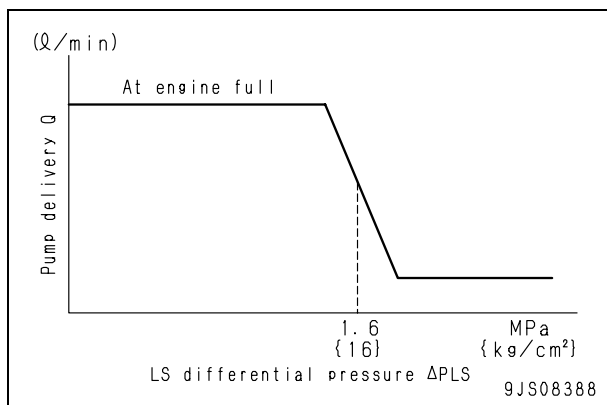


GH : Gear pump HI signal port (a2)
 GL : Gear pump LO signal port (b2)
 P1 : Pump signal pressure port
 P1L : Pump pressure input port
 PAVE : Pump average pressure port
 PE : Control piston pressure port
 PH : Pump shuttle pressure port
 PLS : LS pressure input port
 T : Drain port

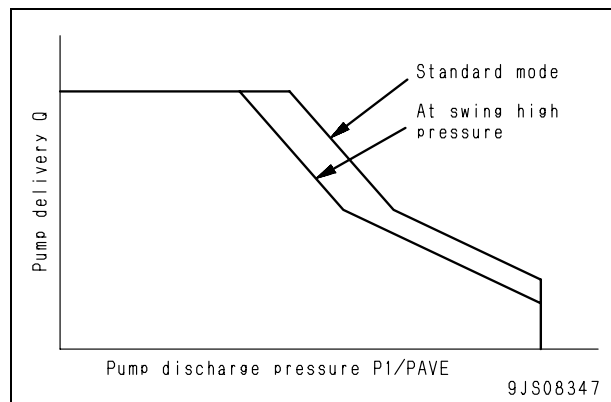
1. Lever
2. Spool
3. Plug
4. Seat
5. Piston
6. Sleeve
7. Plug
8. Locknut
9. Spring
10. Spool
11. PC valve
12. LS valve

Function**1. LS valve**

- The LS valve controls the pump delivery according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve calculates the demand flow for the actuator from differential pressure (ΔPLS) between pump discharge pressure ($P1/PAVE$) and control valve outlet pressure (PLS), and controls pump delivery (Q).
[($P1/PAVE$) is called the pump discharge pressure, (PLS) called the LS pressure, and (ΔPLS) called the LS differential pressure.]
- That is, the pump discharge is controlled according to the demand flow for the actuator by the following method; The pressure loss made when the oil flows through the opening of the control valve spool [LS differential pressure (ΔPLS)] is sensed and pump delivery (Q) is so controlled that the pressure loss will be constant.

**2. PC valve**

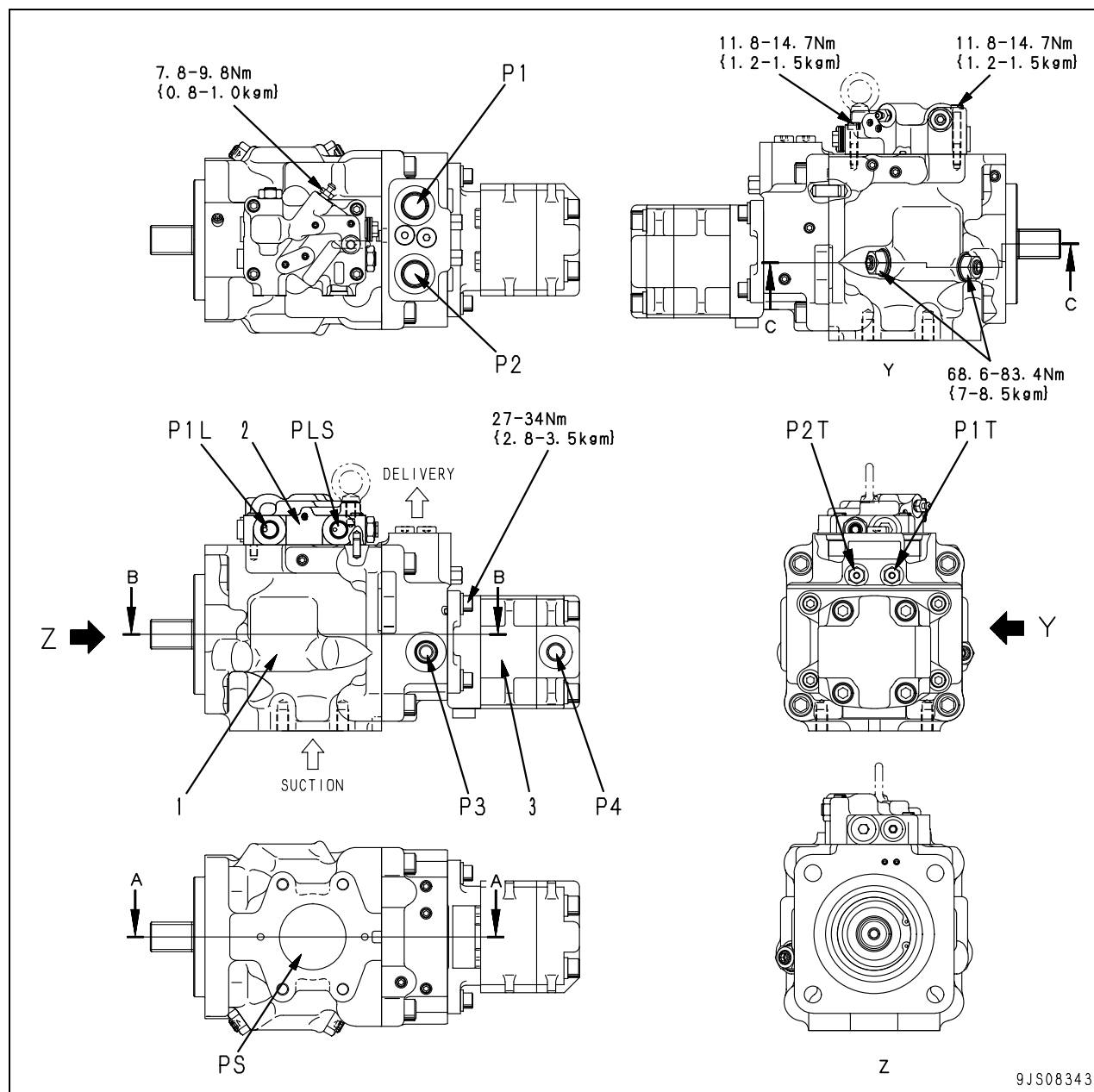
- When pump discharge pressure ($P1/PAVE$) rises, the stroke of the control valve spool is increased and the opening area is increased and pump delivery (Q) is increased. At this time, the PC valve limits pump delivery (Q) according to discharge pressure ($P1/PAVE$) so that the pump absorption horsepower will not exceed the engine horsepower. In other words, the PC valve performs approximate constant-horsepower control.
- That is, if the load on the actuator is increased and pump discharge pressure ($P1/PAVE$) rises during operation, the PC valve reduces pump delivery (Q). If the pump discharge pressure lowers, the PC valve increases pump delivery (Q).
- The relationship between pump discharge pressure ($P1/PAVE$) and pump delivery (Q) is shown below.
- When the machine swings, since the swing pump and main pump are installed tandem, the torque absorbed in the main pump is lowered by the part absorbed in the swing pump.
- When the swing pump operates, the total of the main pump absorption torque and swing pump absorption torque is the total absorption torque (100%)



Type: LPD25 + 25 + SBR8.5 + 5
PC35MR-3 (STD specification)

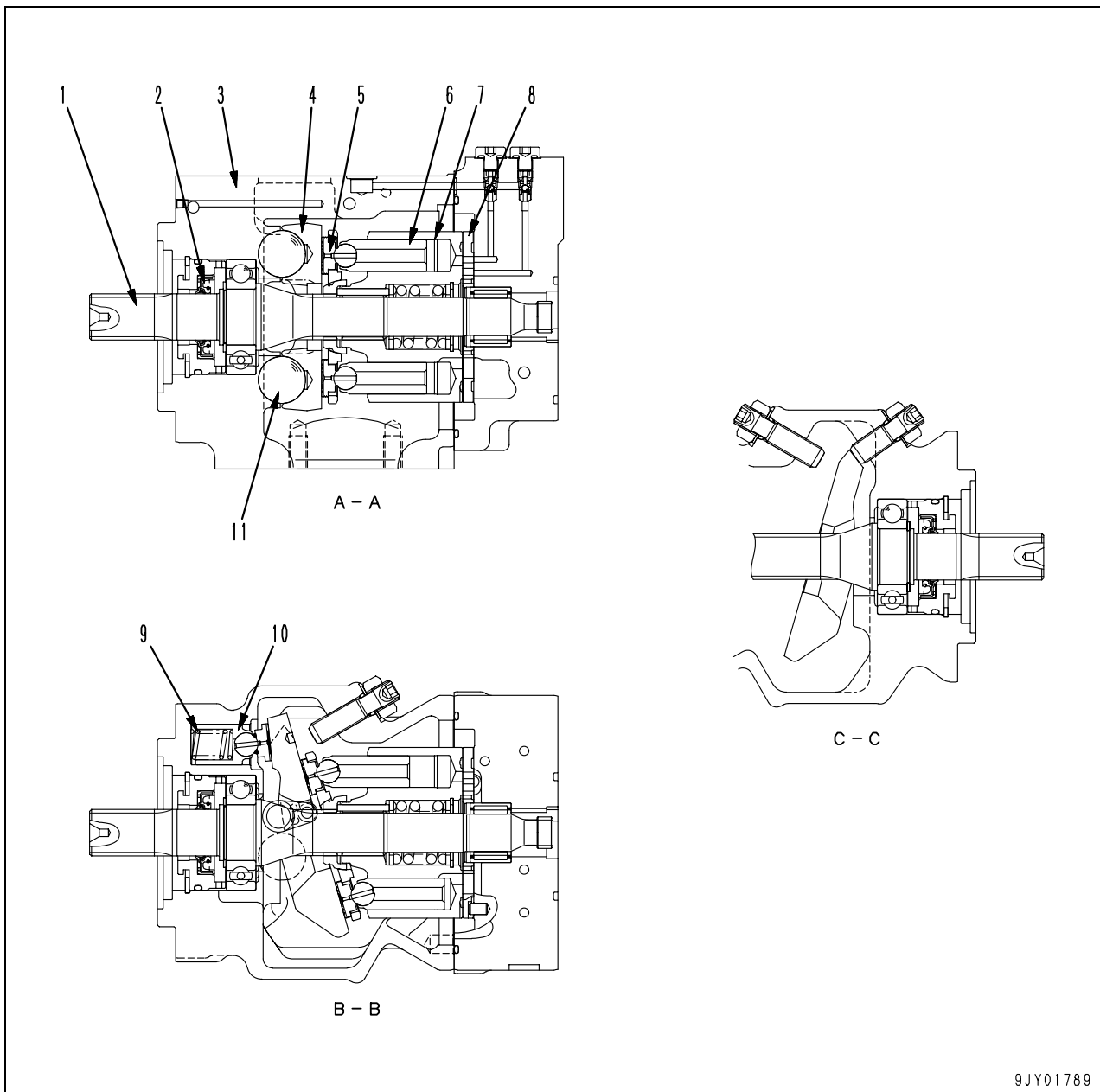
Type: LPD25 + 25 + SBR7.5 + 5
PC35MR-3 (Air conditioner specification)

Main pump



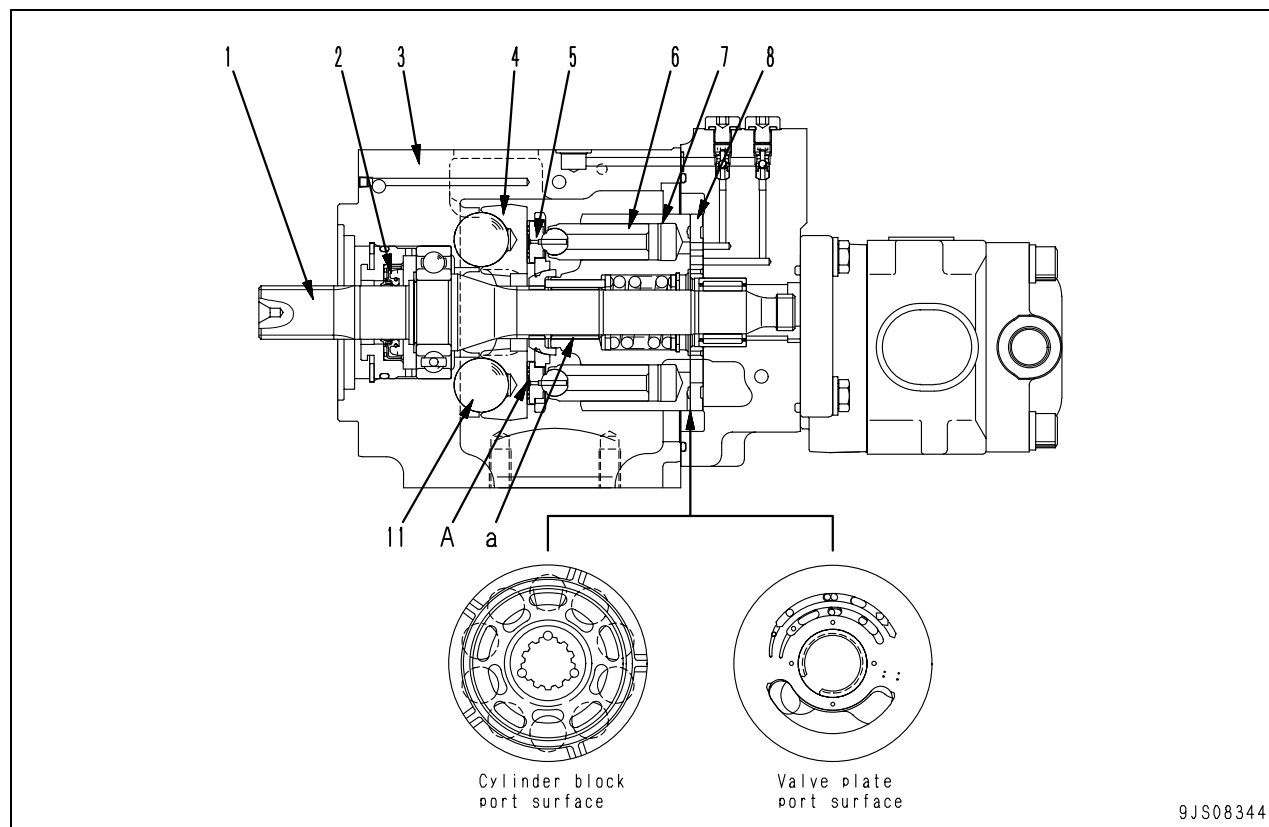
P1 : Pump discharge port
P2 : Pump discharge port
P3 : Gear pump discharge port
P4 : Pilot pump pressure output port
PS : Pump suction port
P1L : Pump pressure input port
P1T : Travel deviation adjustment orifice
P2T : Travel deviation adjustment orifice
PLS : LS pressure input port

1. Main pump (Piston pump)
2. Servo valve
3. Gear pump



1. Shaft
2. Oil seal
3. Case
4. Rocker cam
5. Shoe
6. Piston

7. Cylinder block
8. Valve plate
9. Spring (In servo piston)
10. Servo piston
11. Ball (For supporting rocker cam)



Function

- The engine rotation and torque transmitted to the pump shaft is converted into hydraulic energy, and pressurized oil is discharged according to the load.
- It is possible to change the pump delivery by changing the swash plate angle.
- It has two discharge ports and it enables to supply the pressure individually to each one.

Structure

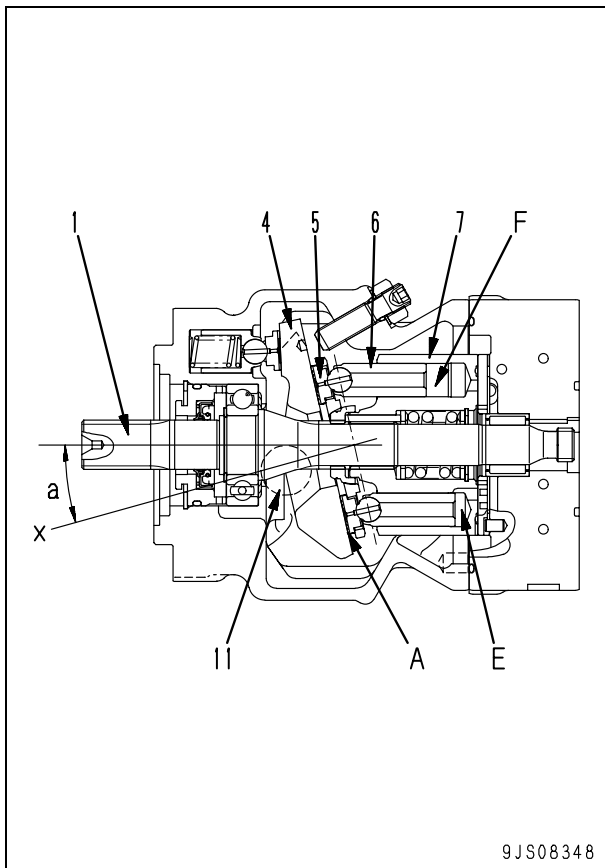
- Cylinder block (7) is supported to shaft (1) by spline (a), and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has flat surface (A). Shoe (5) is kept pressed against the flat surface (A) and it slides circularly on flat surface (A). Rocker cam (4) slides around ball (11).
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).
- Hole number of cylinder block (7) is an even number. So, it is fitted to two grooves of valve plate (8) alternately.

Operations

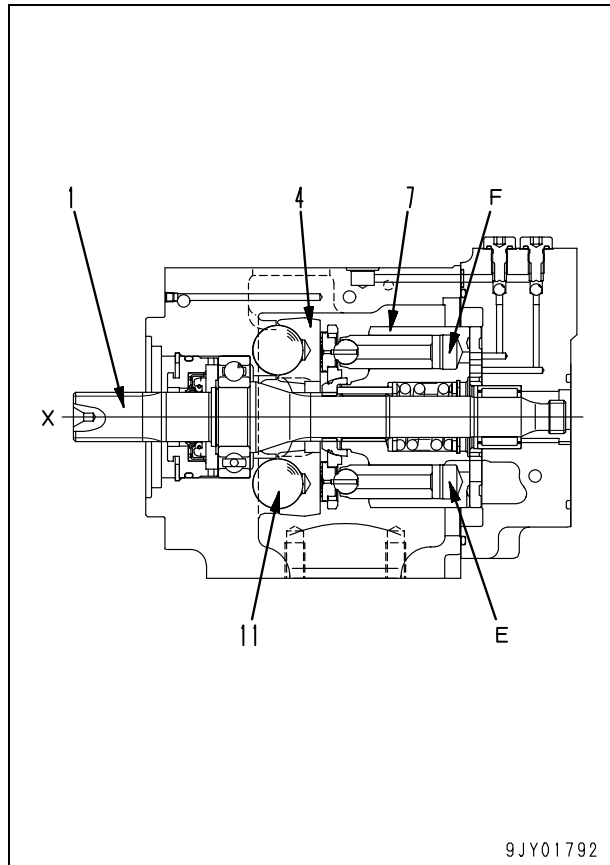
1. Operation of pump

- Shaft (1) and cylinder block (7) rotate together and shoe (5) slides on the flat surface (A). Since the rocker cam (4) leans around ball (11) at this time, the angle (a) between the center line (X) of rocker cam (4) and axis of cylinder block (7) changes. The angle (a) is called the swash plate angle.
- When the center line (X) of the rocker cam (4) maintains the swash plate angle (a) in relation to the axial direction of the cylinder block (7), the flat surface (A) acts as a cam for the shoe (5).
- By this, the piston (6) slides on the inside of the cylinder block (7), creates a difference between capacities (E) and (F), then suction and discharge of oil for the amount of this difference $(F) - (E)$ will be carried out.
- In other words, oil is discharged as the capacity of the chamber (E) decreases when the cylinder block (7) rotates. In the meantime, the capacity of the chamber (F) increases, and the oil is sucked at this process.

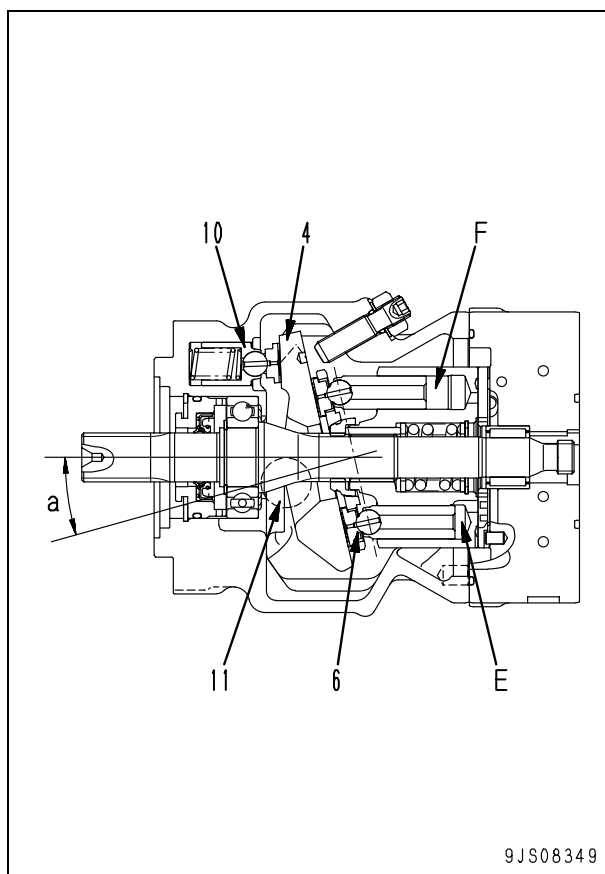
[The figure shows the state of the pump when suction of the chamber (F) and discharge of the chamber (E) have completed.]



- When the center line (X) of the rocker cam (4) becomes in line with the axial direction of the cylinder block (7) (swash plate angle = 0), the difference between capacities of (E) and (F) inside the cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge action of oil. (In actual fact, the swash plate angle never becomes 0.)
- In other words, discharge amount of the pump is directly proportional to the swash plate angle (a).



- As the swash plate angle (a) becomes larger, difference between the capacities (E) and (F) becomes larger, so the pump delivery (Q) increases.
The swash plate angle (a) is changed by the servo piston (10).
- Servo piston (10) is reciprocated straight by the signal pressure of the PC and LS valves. This reciprocation is transferred to rocker cam (4). Rocker cam (4) supported on ball (11) rocks around ball (11).
- The output pressure of the LS valve is applied to the pressure chamber of servo piston (10).
- As output pressure rises, rocker cam (4) moves to reduce the swash plate angle (a), so the pump delivery (Q) decreases.



2. Operation as double pump

- The number of the holes of cylinder block (7) is even. The ports on the face in contact with valve plate (8) are connected to every second long oval port on the periphery of valve plate (8).
- The two long oval ports of valve plate (8) are equivalent to the two discharge ports of the pump, and the pump operates as a double pump.
- While the machine is not traveling, the oil flows are merged inside the control valve and the pump operates as a single pump (Merging mode).
- When the machine travels, the two discharge ports of the pump are connected respectively to the right and left travel ports (Separation mode).
- While the machine is traveling straight, the pump is in the separation mode described above. Since the travel pressures on both sides are the same basically, the pump operates as a single pump. (If the work equipment is operated while the machine is traveling, the pump is set in the merging mode.)
- When the machine steers during travel, however, the pump generates two pressures; One pressure rises for the outer track and the other lowers for the inner track. (For example, the higher pressure is applied to the even cylinder block ports and the lower pressure is applied to the odd ports.)
- As explained above, the oil flow is separated and pressure difference is generated only when the machine is steered during travel.
- The PC control is carried out with the average of the above 2 pump pressures.

3. Superiority of double pump system

- Usually, when the machine having a double pump system is steered during travel, the motor pressure on the drive side (outside) rises and that on the driven side (inside) lowers.
- In the case of an ordinary single pump system, the pressure compensation valve in the control valve operates according to the characteristics of the system, then the motor pressure on the driven side becomes the same as that on the drive side.
- In short, the pressure compensation valve on the driven side is closed and the pressure in the circuit on the driven side and that on the drive side are increased by the same degree.
- In the case of the double pump system, on the other hand, the motor pressure on the driven side is kept low, thus lowering of the oil flow rate in the motor on the drive side is restricted. Accordingly, the engine power is used as shown below;

1) When the single pump system is used

When the machine travels straight:

- Right pressure 9.80 MPa {100 kg/cm²} × Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm²} × Left flow rate (50.0 ℓ/min) = 8.10 kW {11.0 HP} + 8.10 kW {11.0 HP} = 16.2 kW {22.0 HP}

When the machine is steered:

- Right pressure 19.6 MPa {200 kg/cm²} × Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm²} × Left flow rate (40.0 ℓ/min) = 16.2 kW {22.0 HP} + 6.60 kW {9.0 HP} = 22.8 kW {31.0 HP}

Since the pump input horsepower is larger than the engine horsepower, the PC control starts (to prevent the engine from stalling).

- Right pressure 19.6 MPa {200 kg/cm²} × Right flow rate (30.0 ℓ/min) + Left pressure 19.6 MPa {200 kg/cm²} × Left flow rate (20.0 ℓ/min) = 9.60 kW {13.0 HP} + 6.60 kW {9.0 HP} = 16.2 kW {22.0 HP}

The average flow rate of both sides is reduced from 50.0 ℓ/min to 25.0 ℓ/min (Reduction by 50%).

2) When the double pump system is used

When the machine travels straight:

- Right pressure 9.80 MPa {100 kg/cm²} × Right flow rate (50.0 ℓ/min) + Left pressure 9.80 MPa {100 kg/cm²} × Left flow rate (50.0 ℓ/min) = 8.10 kW {11.0 HP} + 8.10 kW {11.0 HP} = 16.2 kW {22.0 HP}

When the machine is steered:

- Right pressure 19.6 MPa {200 kg/cm²} × Right flow rate (50.0 ℓ/min) + Left pressure 4.90 MPa {50 kg/cm²} × Left flow rate (40.0 ℓ/min) = 16.2 kW {22.0 HP} + 2.90 kW {4.0 HP} = 19.1 kW {26.0 HP}

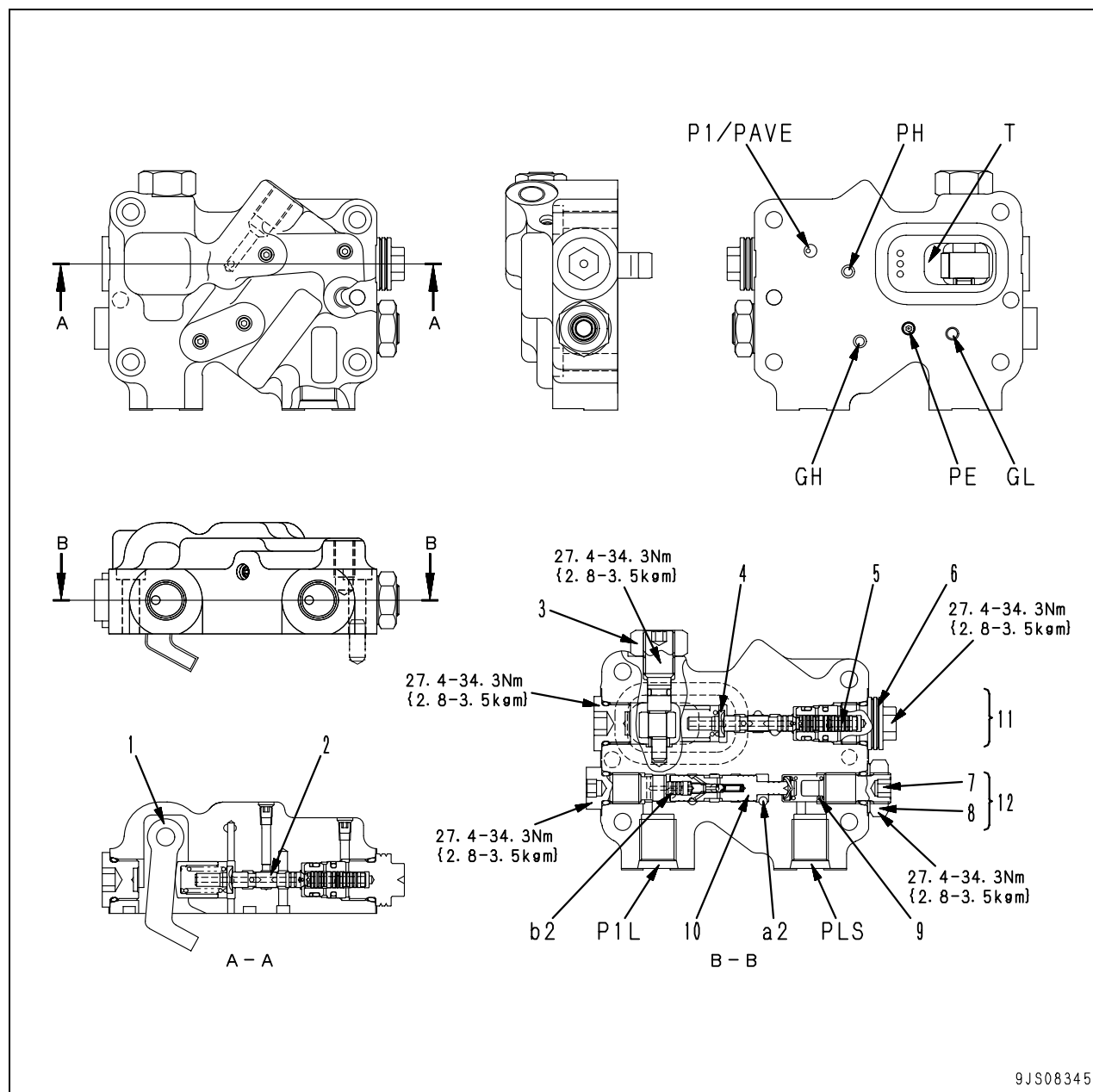
Since the pump input horsepower is larger than the engine horsepower, the PC control starts (to prevent the engine from stalling).

- Right pressure 19.6 MPa {200 kg/cm²} × Right flow rate (43.0 ℓ/min) + Left pressure 4.90 MPa {50.0 kg/cm²} × Left flow rate (33.0 ℓ/min) = 14.0 kW {19.0 HP} + 2.20 kW {3.0 HP} = 16.2 kW {22.0 HP}

The average flow rate of both sides is reduced from 50.0 ℓ/min to 38.0 ℓ/min (Reduction by 24.0%).

When the machine having the ordinary single pump system is steered, the flow rate is reduced by 50%. If the double pump system is used, however, the reduction of the flow rate is only 24%.

Servo valve

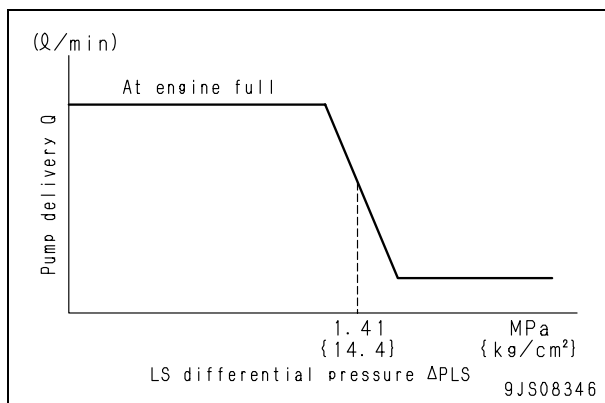


GH : Gear pump HI signal port (a2)
GL : Gear pump LO signal port (b2)
P1 : Pump signal pressure port
P1L : Pump pressure input port
PAVE : Pump average pressure port
PE : Control piston pressure port
PH : Pump shuttle pressure port
PLS : LS pressure input port
T : Drain port

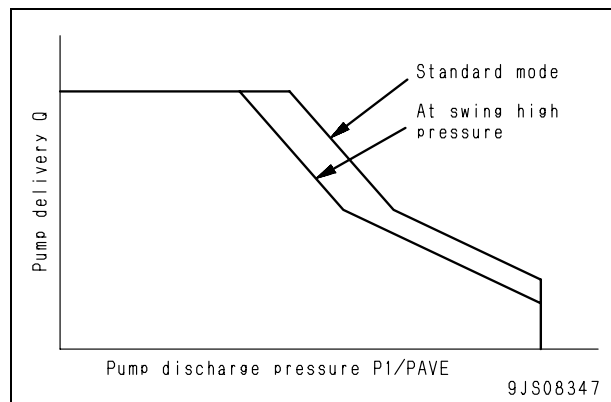
1. Lever
2. Spool
3. Plug
4. Seat
5. Piston
6. Sleeve
7. Plug
8. Locknut
9. Spring
10. Spool
11. PC valve
12. LS valve

Function**1. LS valve**

- The LS valve controls the pump delivery according to the stroke of the control lever, or the demand flow for the actuator.
- The LS valve calculates the demand flow for the actuator from differential pressure (ΔPLS) between pump discharge pressure ($P1/PAVE$) and control valve outlet pressure (PLS), and controls pump delivery (Q).
[($P1/PAVE$) is called the pump discharge pressure, (PLS) called the LS pressure, and (ΔPLS) called the LS differential pressure.]
- That is, the pump discharge is controlled according to the demand flow for the actuator by the following method; The pressure loss made when the oil flows through the opening of the control valve spool [= LS differential pressure (ΔPLS)] is sensed and pump delivery (Q) is so controlled that the pressure loss will be constant.
- The demand flow for the actuator is always supplied, however, as long as it does not exceed the maximum pump discharge in the fine control mode, etc. Accordingly, the pump discharge is kept at the same level, regardless of the engine speed. To prevent this, the LS differential pressure is automatically set low and the pump delivery is reduced when the engine speed is low.

**2. PC valve**

- When pump discharge pressure $P1/PAVE$ rises, the stroke of the control valve spool is increased and the opening area is increased and pump delivery (Q) is increased. At this time, the PC valve limits pump delivery (Q) according to discharge pressure ($P1/PAVE$) so that the pump absorption horsepower will not exceed the engine horsepower. In other words, the PC valve performs approximate constant-horsepower control.
- That is, if the load on the actuator is increased and pump discharge pressure ($P1/PAVE$) rises during operation, the PC valve reduces pump delivery (Q). If the pump discharge pressure lowers, the PC valve increases pump delivery (Q).
- The relationship between pump discharge pressure ($P1/PAVE$) and pump delivery (Q) is shown below.
- When the machine swings, since the swing pump and main pump are installed tandem, the torque absorbed in the main pump is lowered by the part absorbed in the swing pump.
- When the swing pump operates, the total of the main pump absorption torque and swing pump absorption torque is the total absorption torque (100%)



Control valve

Outline

- ★ The control valve is an add-on type where one service valve each can be added, so it is possible to add valves or remove valves if necessary.
- ★ The service valve is installed additionally between the top cover and lower valve.
- ★ As for the 9-spool valve, only the parts different from the 8-spool valve are shown.

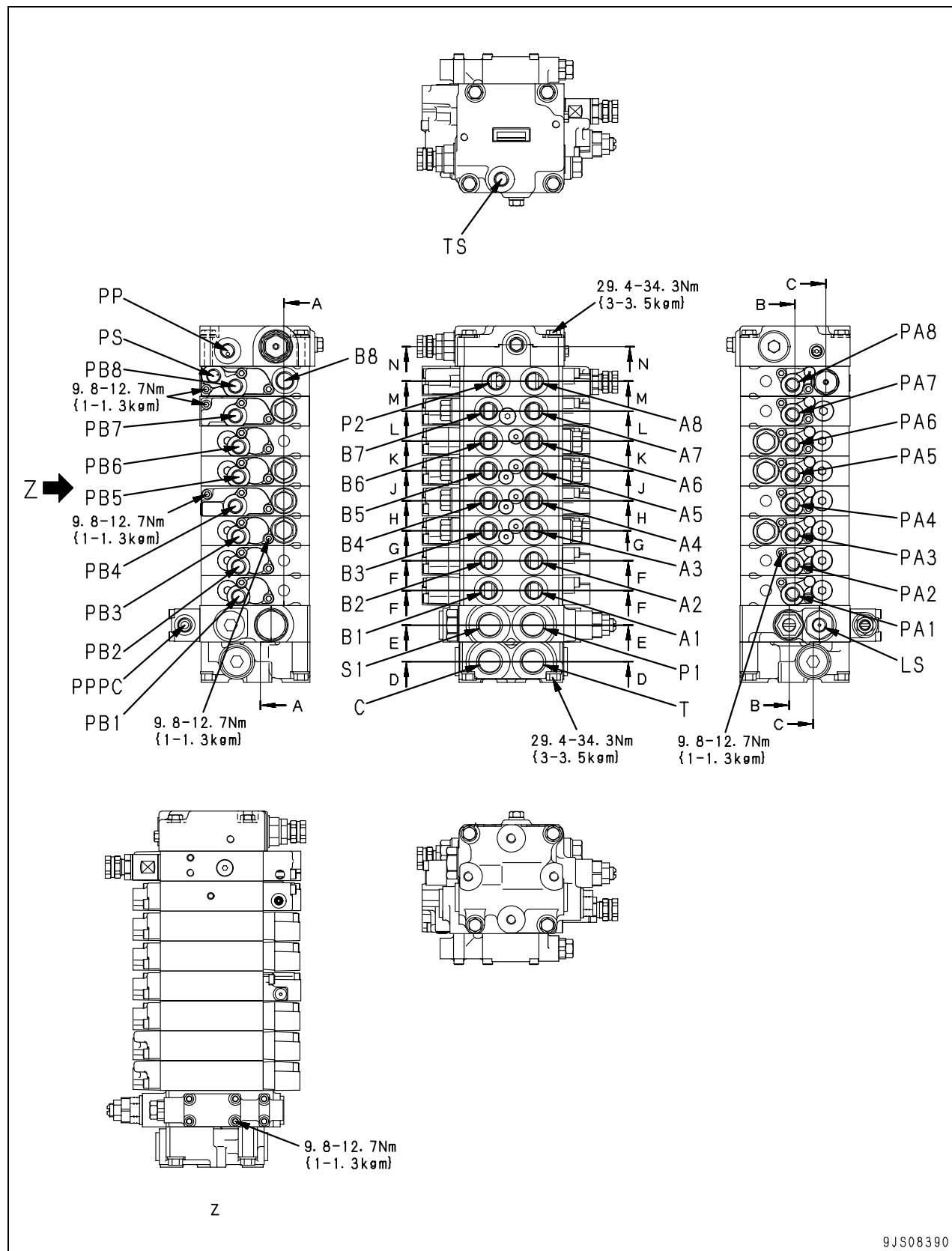
PC27MR, PC30MR-3 (For Standard)

A1	: To R.H. travel motor
A2	: To L.H. travel motor
A3	: To boom cylinder head
A4	: To arm cylinder head
A5	: To bucket cylinder head
A6	: To boom swing cylinder head
A7	: To blade cylinder head
A8	: To swing motor port (MA)
B1	: To R.H. travel motor
B2	: To L.H. travel motor
B3	: To boom cylinder bottom
B4	: To arm cylinder bottom
B5	: To bucket cylinder bottom
B6	: To boom swing cylinder bottom
B7	: To blade cylinder bottom
B8	: To swing motor port (MB)
C	: To oil cooler
LS	: To pump LS valve
P1	: From main pump (Variable pump)
P2	: From main pump (Gear pump)
PA1	: From R.H. travel FORWARD PPC valve
PA2	: From L.H. travel FORWARD PPC valve
PA3	: From boom LOWER PPC valve
PA4	: From arm OUT PPC valve
PA5	: From bucket DUMP PPC valve
PA6	: From boom swing PPC valve
PA7	: From blade PPC valve
PA8	: From swing L.H. PPC valve
PB1	: From R.H. travel REVERSE PPC valve
PB2	: From L.H. travel REVERSE PPC valve
PB3	: From boom RAISE PPC valve
PB4	: From arm IN PPC valve
PB5	: From bucket CURL PPC valve
PB6	: From boom swing PPC valve
PB7	: From blade PPC valve
PB8	: From swing R.H. PPC valve
PP	: To pump LS valve
PPPC	: To solenoid valve port (P)
S1	: To swing motor port (S)
PS	: To swing motor port (B)
T	: To tank
TS	: To tank

1. 8-spool valve

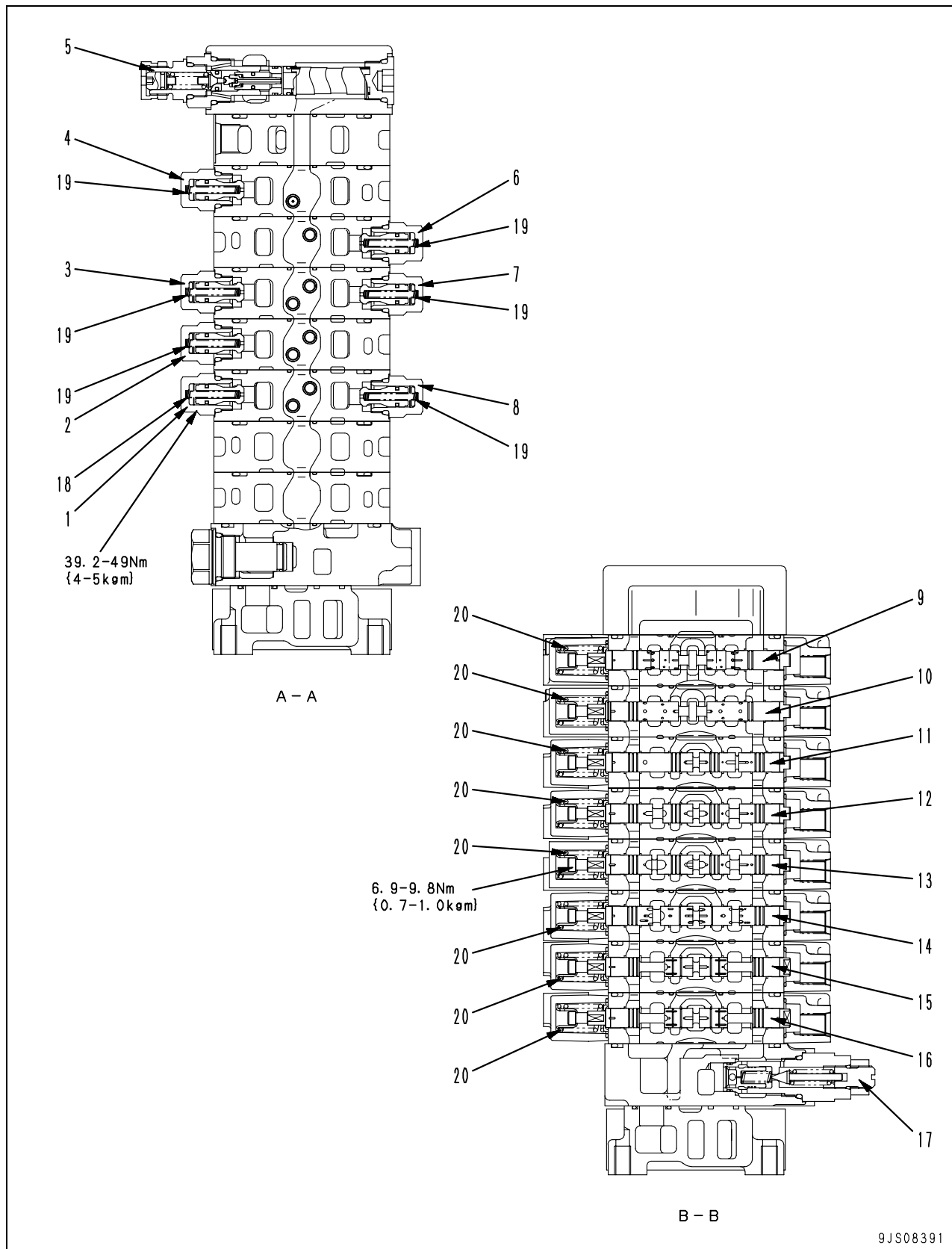
PC27MR, PC30MR-3

General view



Sectional view

(1/5)



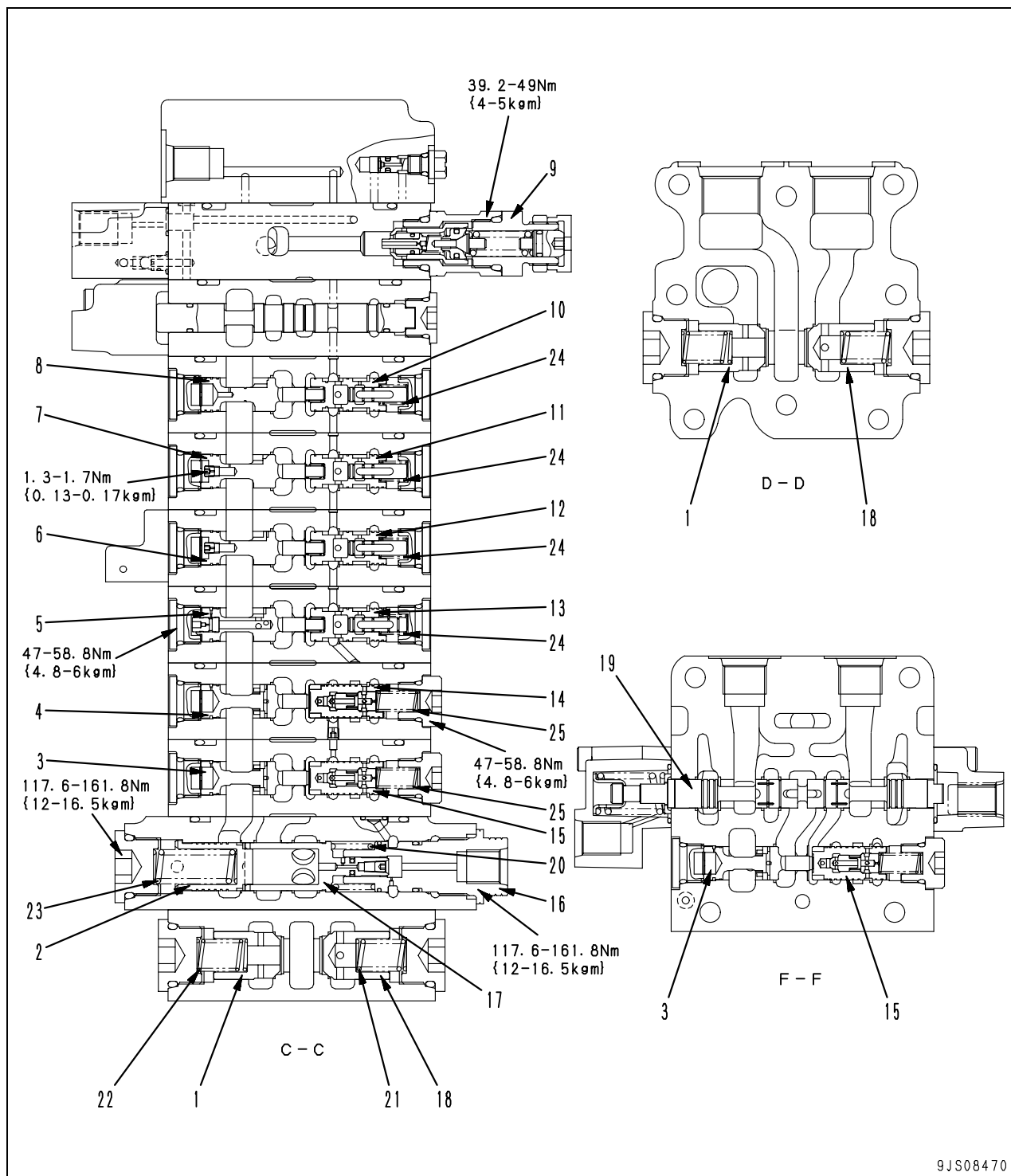
1. Suction valve (Boom bottom)
2. Suction valve (Arm bottom)
3. Suction valve (Bucket bottom)
4. Suction valve (Blade bottom)
5. Safety valve
6. Suction valve (Boom swing head)
7. Suction valve (Bucket head)
8. Suction valve (Boom head)
9. Spool (Swing)
10. Spool (Blade)
11. Spool (Boom swing)
12. Spool (Bucket)
13. Spool (Arm)
14. Spool (Boom)
15. Spool (L.H. travel)
16. Spool (R.H. travel)
17. Main relief valve

Unit: mm

No.	Check item	Criteria					Remedy
18	Suction valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		36.3 × 4.45	33.3	2.65 N {0.27 kg}	—	2.16 N {0.22 kg}	
19	Suction valve spring	39.2 × 4.45	33.5	5.10 N {0.52 kg}	—	4.12 N {0.42 kg}	
20	Spool return spring	29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.80 kg}	

PC27MR-3

(2/5)



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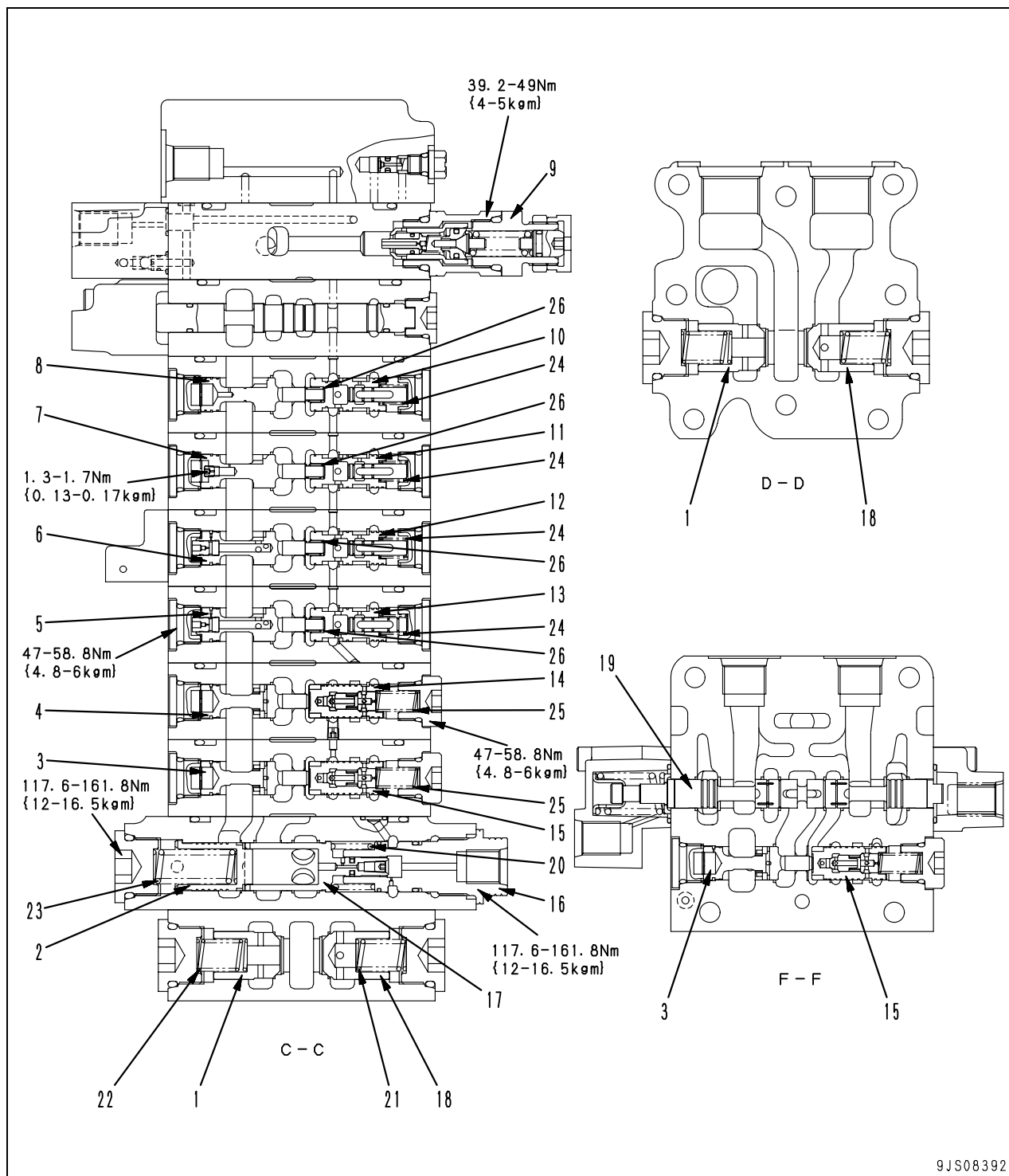
- | | |
|--|---|
| 1. Back pressure check valve | 11. Pressure compensation valve R (Bucket) |
| 2. Self pressure reducing sequence valve | 12. Pressure compensation valve R (Arm) |
| 3. Pressure compensation valve F (R.H. travel) | 13. Pressure compensation valve R (Boom) |
| 4. Pressure compensation valve F (L.H. travel) | 14. Pressure compensation valve R (L.H. travel) |
| 5. Pressure compensation valve F (Boom) | 15. Pressure compensation valve R (R.H. travel) |
| 6. Pressure compensation valve F (Arm) | 16. LS bypass valve |
| 7. Pressure compensation valve F (Bucket) | 17. Unload valve |
| 8. Pressure compensation valve F (Boom swing) | 18. Cooler bypass valve |
| 9. Swing relief valve (for gear pump) | 19. Spool (travel) |
| 10. Pressure compensation valve R (Boom swing) | |
- F:Flow control valve
R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
20	Unload valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		28.57 × 19.2	16.5	172 N {17.5 kg}	—	137 N {14 kg}	
21	Cooler check valve spring	27.2 × 13.2	21	78.8 N {8.04 kg}	—	63.1 N {6.43 kg}	
22	Back pressure check valve spring	29 × 13.3	21	15.3 N {1.56 kg}	—	12.3 N {1.25 kg}	
23	Self pressure reducing sequence valve spring	40.5 × 14.3	35.5	88.3 N {9.0 kg}	—	70.6 N {7.2 kg}	
24	Pressure compensation valve spring	20.0 × 8.40	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	
25	Pressure compensation valve spring	22.5 × 8.4	18.2	9.75 N {0.99 kg}	—	7.8 N {0.80 kg}	

PC30MR-3

(3/5)

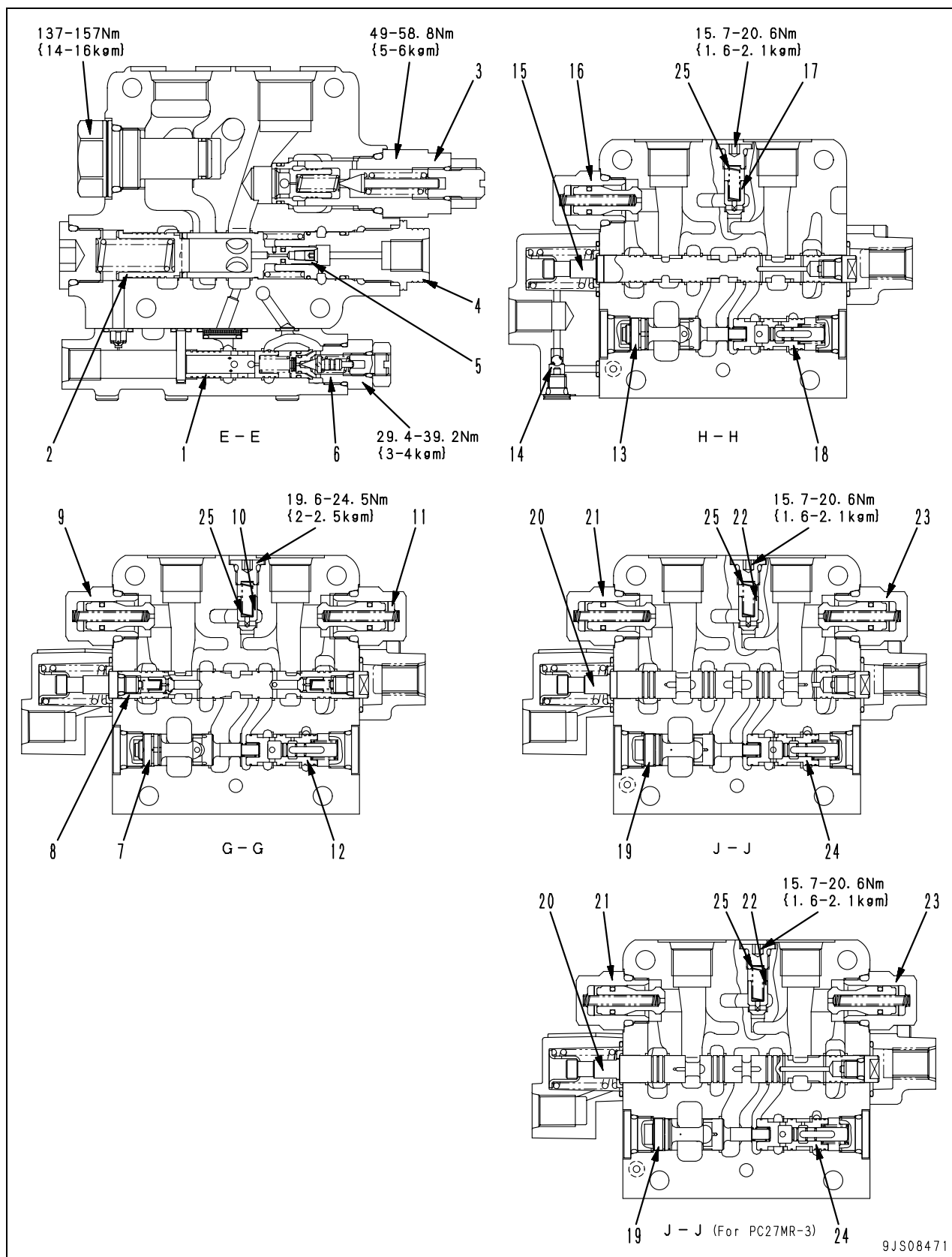


- | | |
|--|---|
| 1. Back pressure check valve | 11. Pressure compensation valve R (Bucket) |
| 2. Self pressure reducing sequence valve | 12. Pressure compensation valve R (Arm) |
| 3. Pressure compensation valve F (R.H. travel) | 13. Pressure compensation valve R (Boom) |
| 4. Pressure compensation valve F (L.H. travel) | 14. Pressure compensation valve R (L.H. travel) |
| 5. Pressure compensation valve F (Boom) | 15. Pressure compensation valve R (R.H. travel) |
| 6. Pressure compensation valve F (Arm) | 16. LS bypass valve |
| 7. Pressure compensation valve F (Bucket) | 17. Unload valve |
| 8. Pressure compensation valve F (Boom swing) | 18. Cooler bypass valve |
| 9. Swing relief valve (for gear pump) | 19. Spool (travel) |
| 10. Pressure compensation valve R (Boom swing) | F: Flow control valve |
| | R: Pressure reducing valve |

Unit: mm

No.	Check item	Criteria					Remedy
20	Unload valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		28.57 × 19.2	16.5	172 N {17.5 kg}	—	137 N {14 kg}	
21	Cooler check valve spring	27.2 × 13.2	21	78.8 N {8.04 kg}	—	63.1 N {6.43 kg}	
22	Back pressure check valve spring	29 × 13.3	21	15.3 N {1.56 kg}	—	12.3 N {1.25 kg}	
23	Self pressure reducing sequence valve spring	40.5 × 14.3	35.5	88.3 N {9.0 kg}	—	70.6 N {7.2 kg}	
24	Pressure compensation valve spring	20.0 × 8.4	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	
25	Pressure compensation valve spring	22.5 × 8.4	18.2	9.75 N {0.99 kg}	—	7.8 N {0.80 kg}	
26	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.98 N {0.61 kg}	

(4/5)

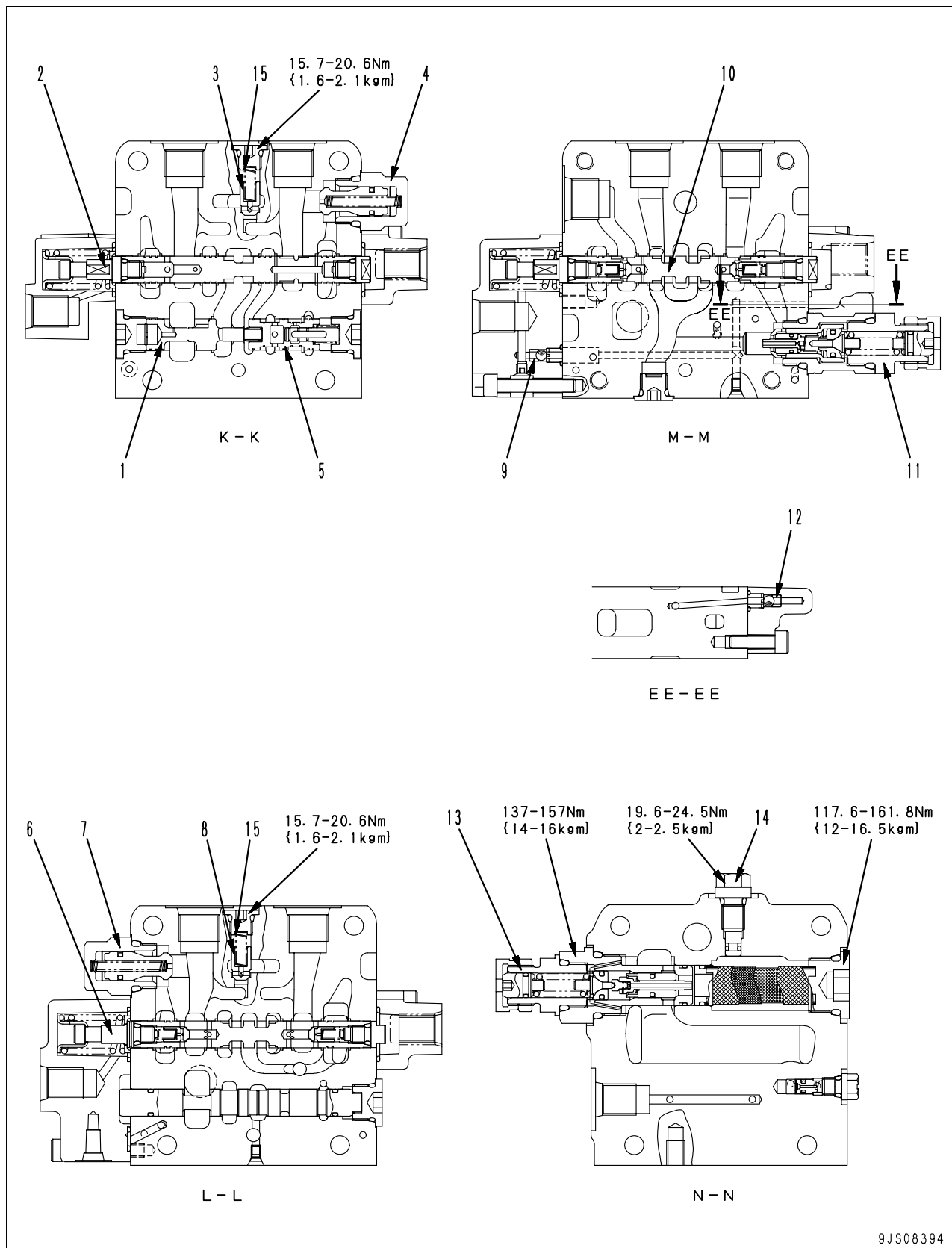


- | | |
|--|--|
| 1. Self pressure reducing spool | 15. Spool (Arm) |
| 2. Self pressure reducing sequence valve | 16. Suction valve |
| 3. Main relief valve | 17. Check valve |
| 4. LS bypass valve | 18. Pressure compensation valve R (Arm) |
| 5. Unload valve | 19. Pressure compensation valve F (Bucket) |
| 6. Self pressure reducing valve | 20. Spool (Bucket) |
| 7. Pressure compensation valve F (Boom) | 21. Suction valve |
| 8. Spool (Boom) | 22. Check valve |
| 9. Suction valve | 23. Suction valve |
| 10. Check valve | 24. Pressure compensation valve R (Bucket) |
| 11. Suction valve | |
| 12. Pressure compensation valve R (Boom) | F: Flow control valve |
| 13. Pressure compensation valve F (Arm) | R: Pressure reducing valve |
| 14. Pilot check valve | |

Unit: mm

No.	Check item	Criteria					Remedy
25	Check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		21.9 × 5	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

(5/5)



9JS08394

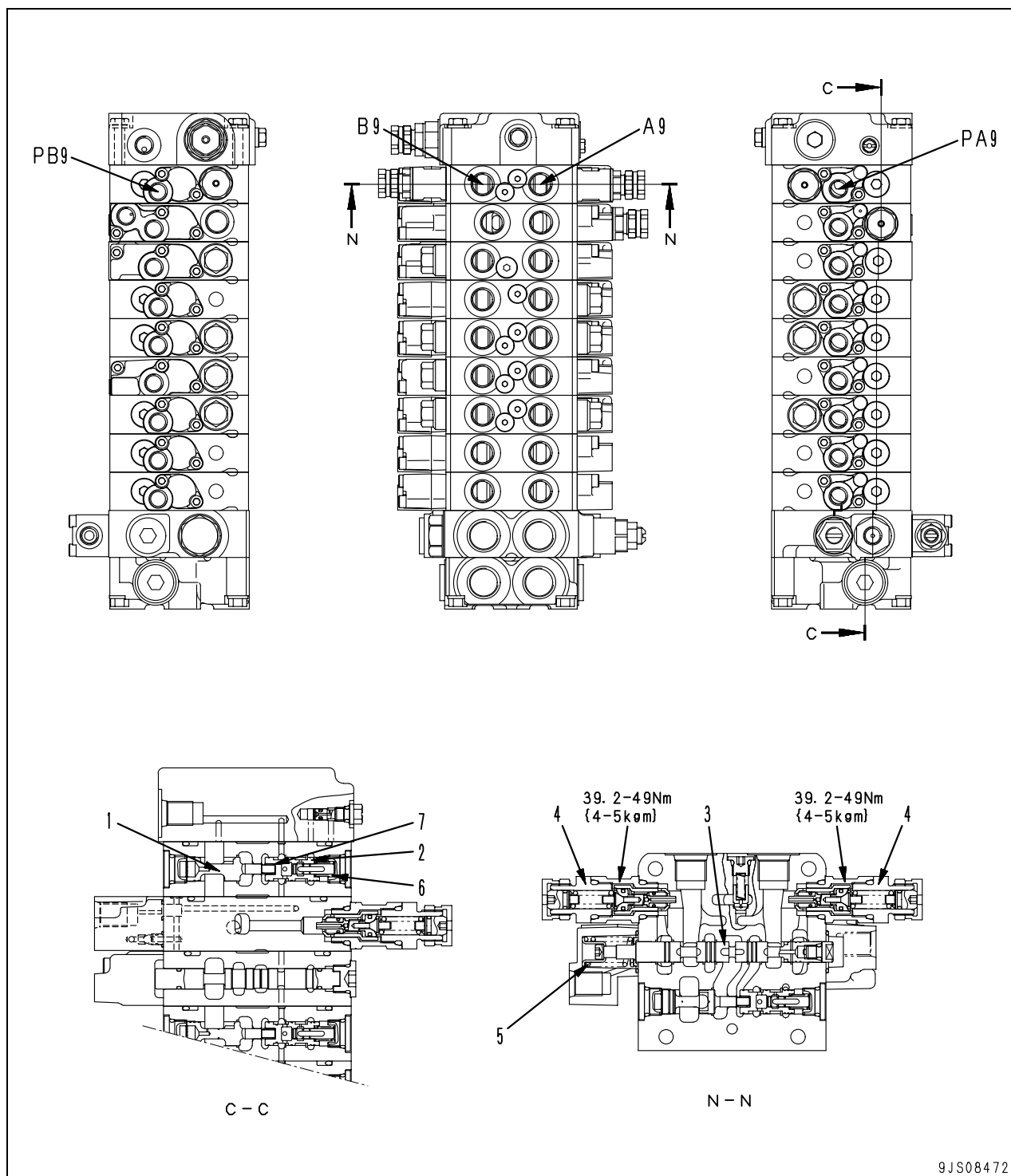
1. Pressure compensation valve F (Boom swing)
2. Spool (Boom swing)
3. Check valve
4. Suction valve
5. Pressure compensation valve R (Boom swing)
6. Spool (Blade)
7. Suction valve
8. Check valve
9. Pilot pressure check valve
10. Spool (Swing)
11. Swing relief valve (For gear pump)
12. Pilot pressure check valve
13. Safety valve
14. Air bleeding plug

F:Flow control valve

R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
16	Check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		21.9 × 5	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

2. 9-spool valve**PC27MR, PC30MR-3 (For Standard)****PC27MR-3 (For North America)**

- ★ These are the 9-spool valves of PC27MR-3 (For standard and North America) and PC30MR-3 (For standard), the shapes of which, except section MM-MM, are the same as that of the 9-spool valve of PC27MR-3 (For standard).

A9 : To stop valve
B9 : To stop valve
PA9 : To attachment PPC valve
PB9 : To attachment PPC valve

1. Pressure compensation valve F (Attachment)
2. Pressure compensation valve R (Attachment)
3. Spool (Attachment)
4. Port relief valve

F:Flow control valve
R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
5	Spool return spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		29 × 17.5	28.5	22.6 N {2.30 kg}	—	1.81 N {1.80 kg}	
6	Pressure compensation valve spring	20.0 × 8.4	12.0	6.86 N {0.70 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
7	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.98 N {0.61 kg}	

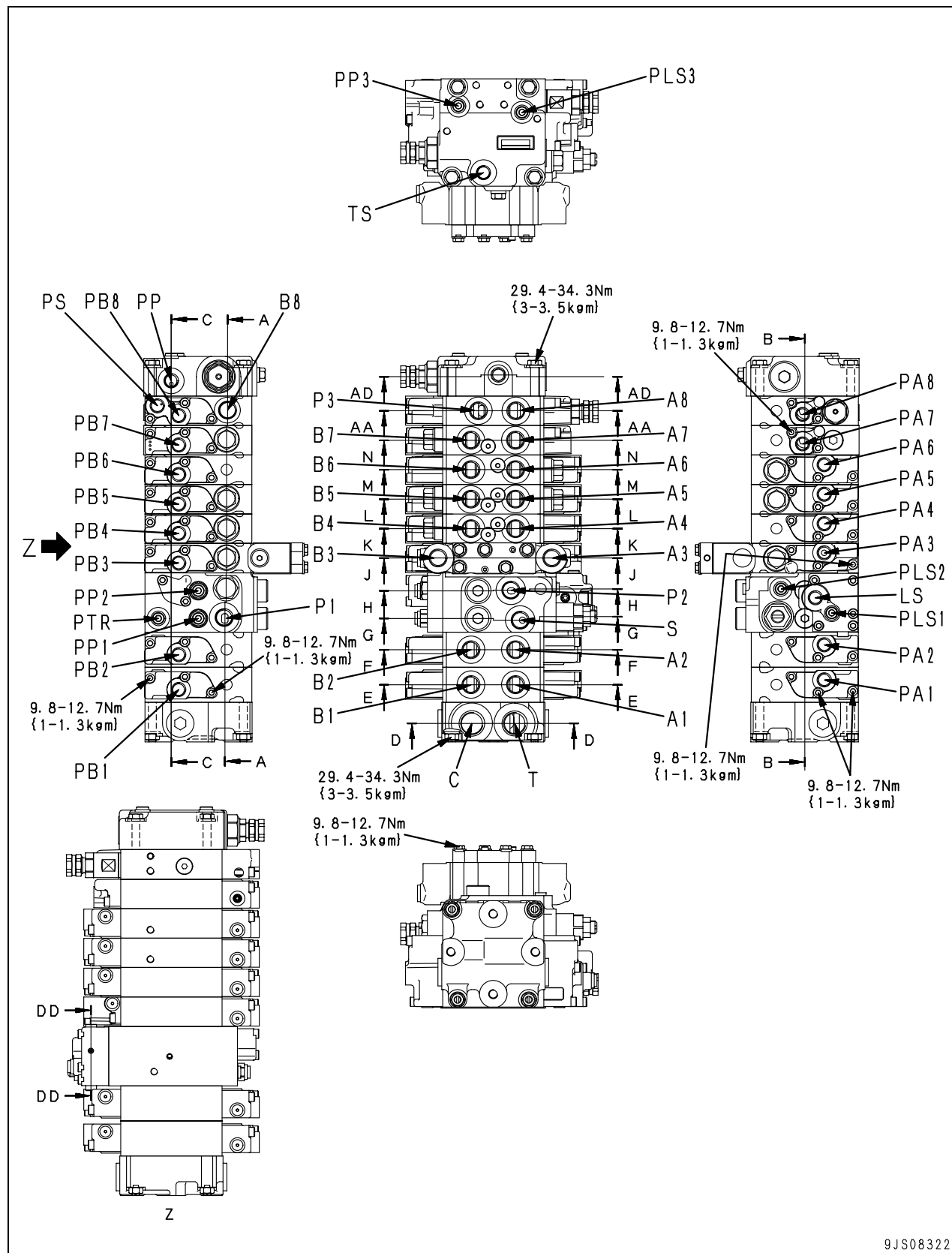
PC35MR-3 (For standard)**Outline**

- ★ The control valve is an add-on type where one service valve each can be added, so it is possible to add valves or remove valves if necessary.
- ★ The service valve is installed additionally between the top cover and lower valve.
- ★ As for the 9-spool valve, only the parts different from the 8-spool valve are shown.

A1	: To R.H. travel motor	PA5	: From bucket DUMP PPC valve
A2	: To L.H. travel motor	PA6	: From boom swing PPC valve
A3	: To boom cylinder head	PA7	: From blade PPC valve
A4	: To arm cylinder head	PA8	: From swing L.H. PPC valve
A5	: To bucket cylinder head	PB1	: From right travel REVERSE PPC valve
A6	: To boom swing cylinder head	PB2	: From left travel REVERSE PPC valve
A7	: To blade cylinder head	PB3	: From boom RAISE PPC valve
A8	: To swing motor port (MA)	PB4	: From arm IN PPC valve
B1	: To R.H. travel motor	PB5	: From bucket CURL PPC valve
B2	: To L.H. travel motor	PB6	: From boom swing PPC valve
B3	: To boom cylinder bottom	PB7	: From blade PPC valve
B4	: To arm cylinder bottom	PB8	: From swing R.H. PPC valve
B5	: To bucket cylinder bottom	PP	: To pump LS valve
B6	: To boom swing cylinder bottom	PP1	: (P1) pump pressure
B7	: To blade cylinder bottom	PP2	: (P2) pump pressure
B8	: To swing motor port (MB)	PP3	: Pump pressure on work equipment side
C	: To oil cooler	PLS1	: Left travel LS pressure
LS	: To pump LS valve	PLS2	: Right travel LS pressure
P1	: From main pump (Variable pump)	PLS3	: Work equipment LS pressure
P2	: From main pump (Variable pump)	PTR	: Travel pressure switch mounting port
P3	: From main pump (Gear pump)	PS	: To swing motor port (B)
PA1	: From right travel FORWARD PPC valve	S	: To swing motor port (S)
PA2	: From left travel FORWARD PPC valve	T	: To tank
PA3	: From boom LOWER PPC valve	TS	: To tank
PA4	: From arm OUT PPC valve		

1. 8-spool valve

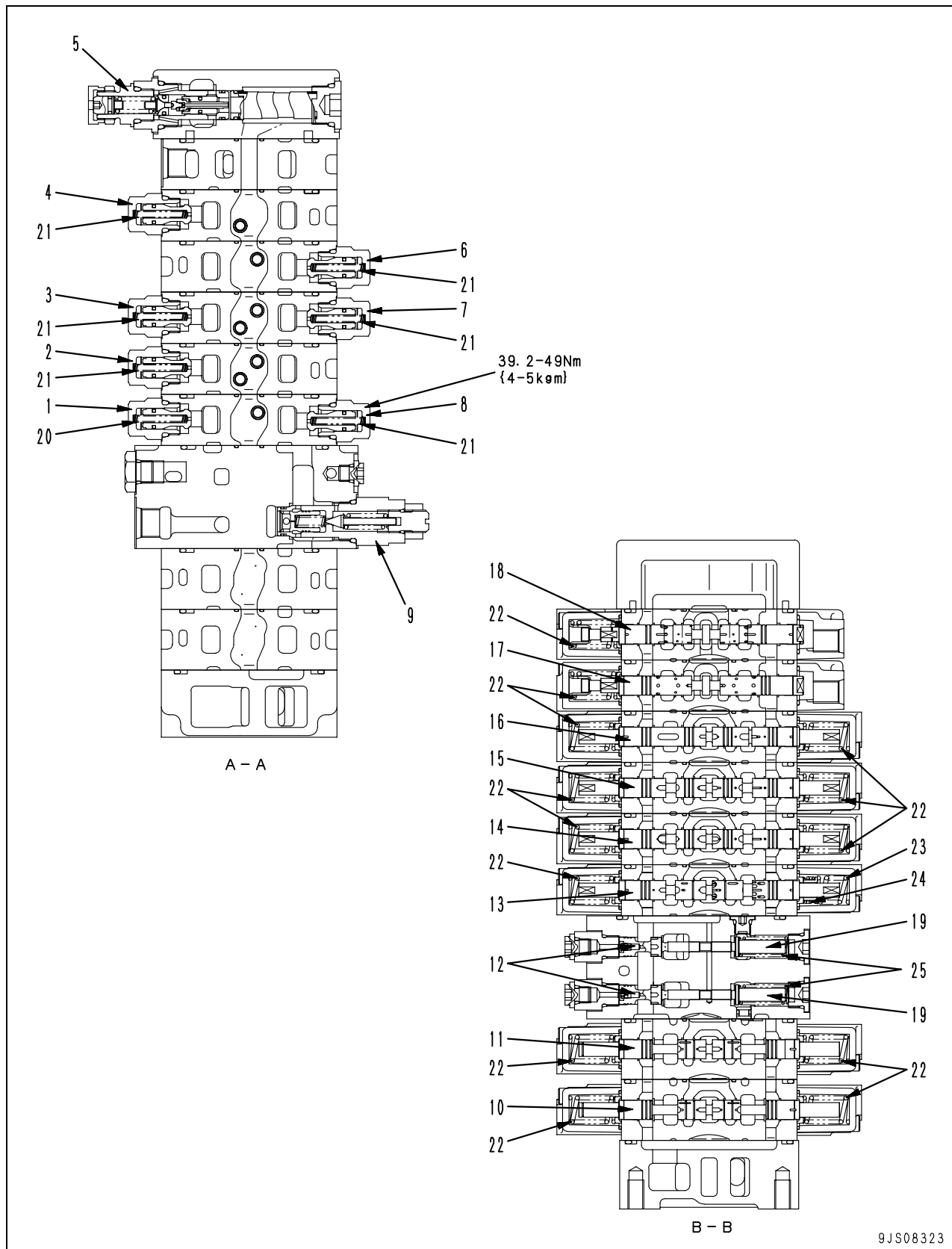
General view



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Sectional view

(1/4)

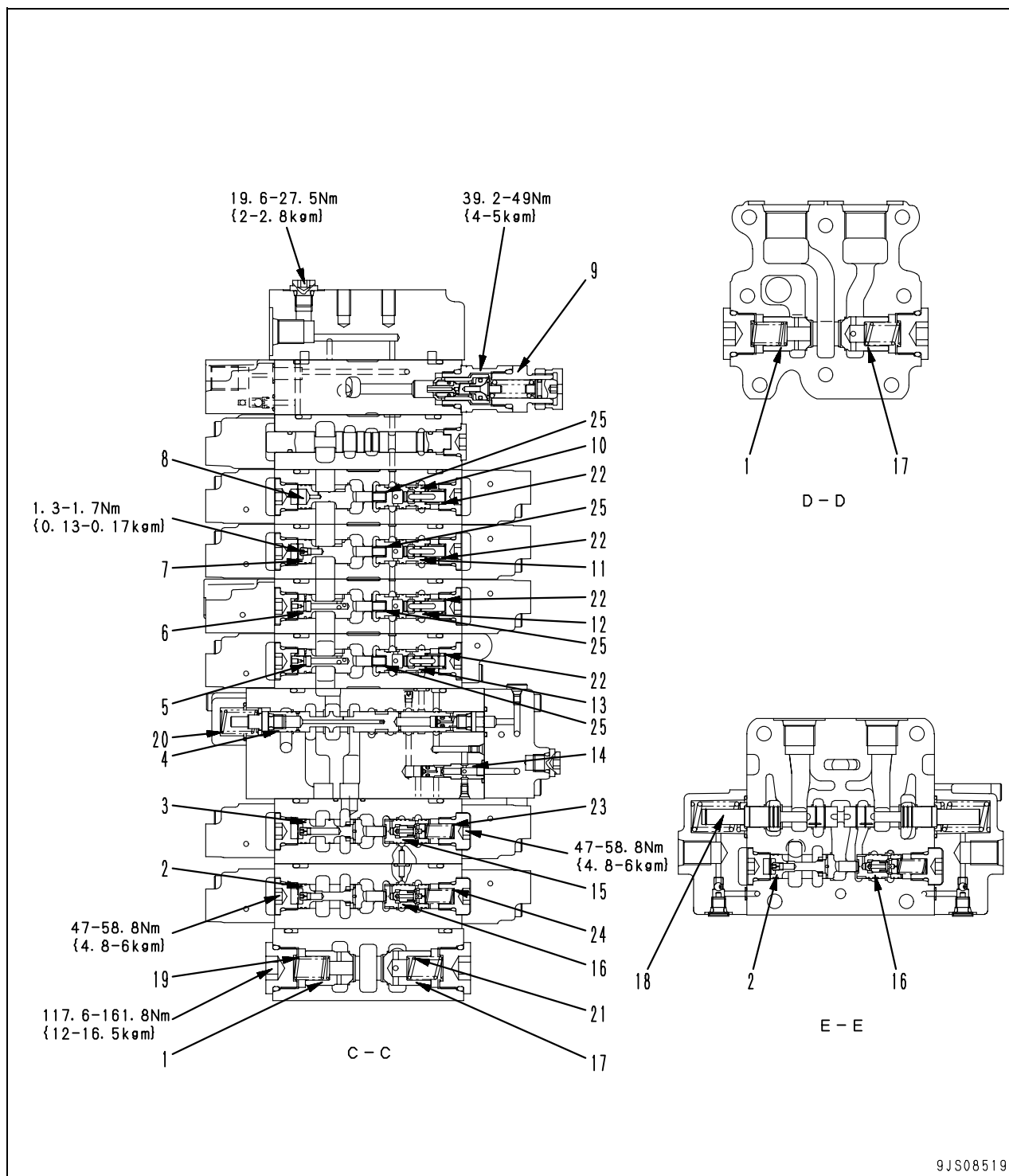


1. Suction valve (Boom bottom)
2. Suction valve (Arm bottom)
3. Suction valve (Bucket bottom)
4. Suction valve (Blade bottom)
5. Safety valve
6. Suction valve (Boom swing head)
7. Suction valve (Bucket head)
8. Suction valve (Boom head)
9. Main relief valve
10. Spool (L.H. travel)
11. Spool (R.H. travel)
12. Unload valve
13. Spool (Boom)
14. Spool (Arm)
15. Spool (Bucket)
16. Spool (Boom swing)
17. Spool (Blade)
18. Spool (Swing)
19. Unload valve

Unit: mm

No.	Check item	Criteria					Remedy
20	Suction valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		36.3 × 4.45	33.3	2.65 N {0.27 kg}	—	2.16 N {0.22 kg}	
21	Suction valve spring	39.62 × 4.5	33.3	15.9 N {1.626 kg}	—	12.7 N {1.30 kg}	
22	Spool return spring	29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.83 kg}	
23	Spool return spring	20.25 × 17.6	19	55.4 N {5.65 kg}	—	44.3 N {4.52 kg}	
24	Spool return spring	13.07 × 16.7	8.5	55.4 N {5.65 kg}	—	44.3 N {4.52 kg}	
25	Unload valve spring	37.2 × 12.5	30.5	55.4 N {5.65 kg}	—	44.3 N {4.52 kg}	

(2/4)



1. Lift check valve
2. Pressure compensation valve F (Right travel)
3. Pressure compensation valve F (Left travel)
4. Spool (Pump merge-divider valve)
5. Pressure compensation valve F (Boom)
6. Pressure compensation valve F (Arm)
7. Pressure compensation valve F (Bucket)
8. Pressure compensation valve F (Boom swing)
9. Swing relief valve (For gear pump)
10. Pressure compensation valve R (Boom swing)
11. Pressure compensation valve R (Bucket)
12. Pressure compensation valve R (Arm)
13. Pressure compensation valve R (Boom)
14. LS bypass valve (LS2)
15. Pressure compensation valve R (Left travel)
16. Pressure compensation valve R (Right travel)
17. Cooler bypass valve
18. Spool (Right travel)

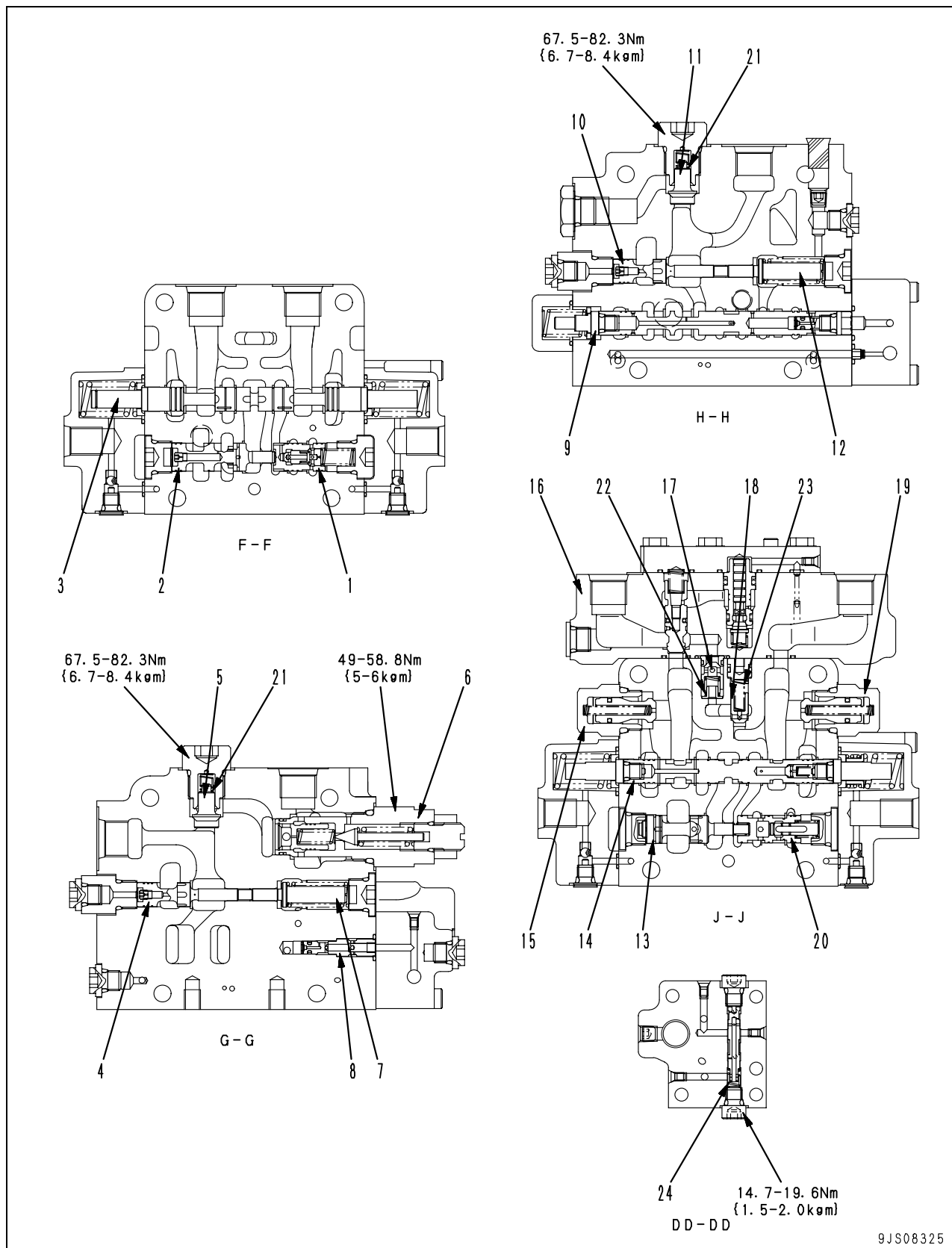
F:Flow control valve

R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
19	Back pressure check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		29 × 13.3	21	15.3 N {1.56 kg}	—	12.3 N {1.25 kg}	
20	Pump merge-divider valve spring	41.07 × 13.8	22	44.3 N {4.52 kg}	—	35.5 N {3.62 kg}	
21	Cooler check valve spring	27.2 × 13.2	21	78.8 N {8.04 kg}	—	63.1 N {6.43 kg}	
22	Pressure compensation valve spring	20 × 8.4	12	6.86 N {0.7 kg}	—	5.49 N {0.56 kg}	
23	Pressure compensation valve spring	22.11 × 8.4	17	10.4 N {1.06 kg}	—	8.34 N {0.85 kg}	
24	Pressure compensation valve spring	21.55 × 8.4	17	8.34 N {0.85 kg}	—	6.67 N {0.68 kg}	
25	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.98 N {0.61 kg}	

(3/4)



1. Pressure compensation valve R (Left travel)
2. Pressure compensation valve F (Left travel)
3. Spool (Left travel)
4. Unload valve
5. Check valve
6. Main relief valve
7. Unload valve
8. LS bypass valve (LS2)
9. Spool (Pump merge-divider valve)
10. Unload valve
11. Check valve
12. Unload valve
13. Pressure compensation valve F (Boom)
14. Spool (Boom)
15. Suction valve
16. Boom hydraulic drift prevention valve
17. Check valve
18. Check valve
19. Suction valve
20. Pressure compensation valve R (Boom)

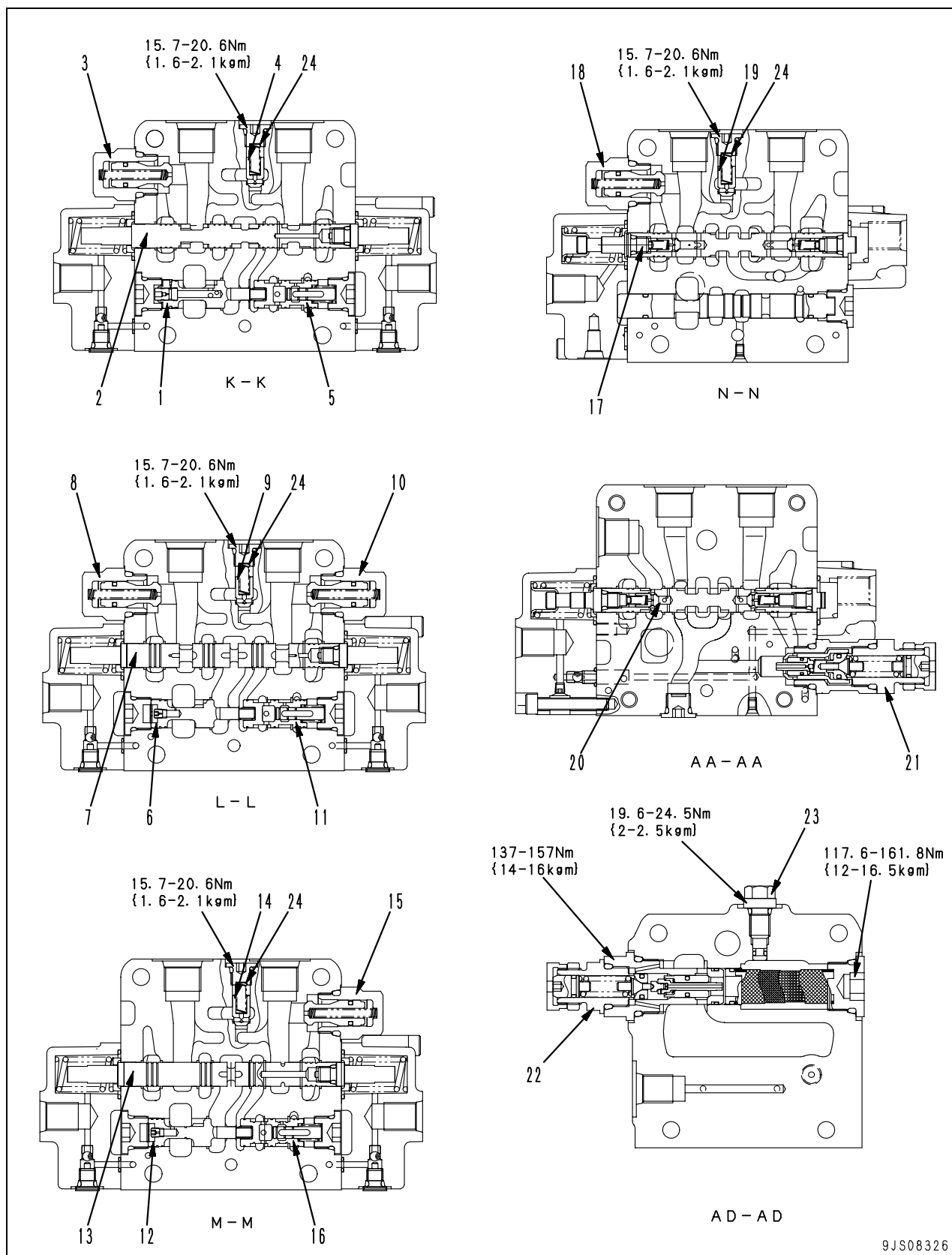
F:Flow control valve

R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
21	Check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		13.0 × 6.50	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
22	Check valve spring (Boom)	16.4 × 7.5	9.9	2.25 N {0.23 kg}	—	1.77 N {0.18 kg}	
23	Check valve spring (Boom)	21.9 × 5	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
24	Logic valve spring	10.98 × 6.2	9.5	5.49 N {0.56 kg}	—	4.41 N {0.45 kg}	

(4/4)



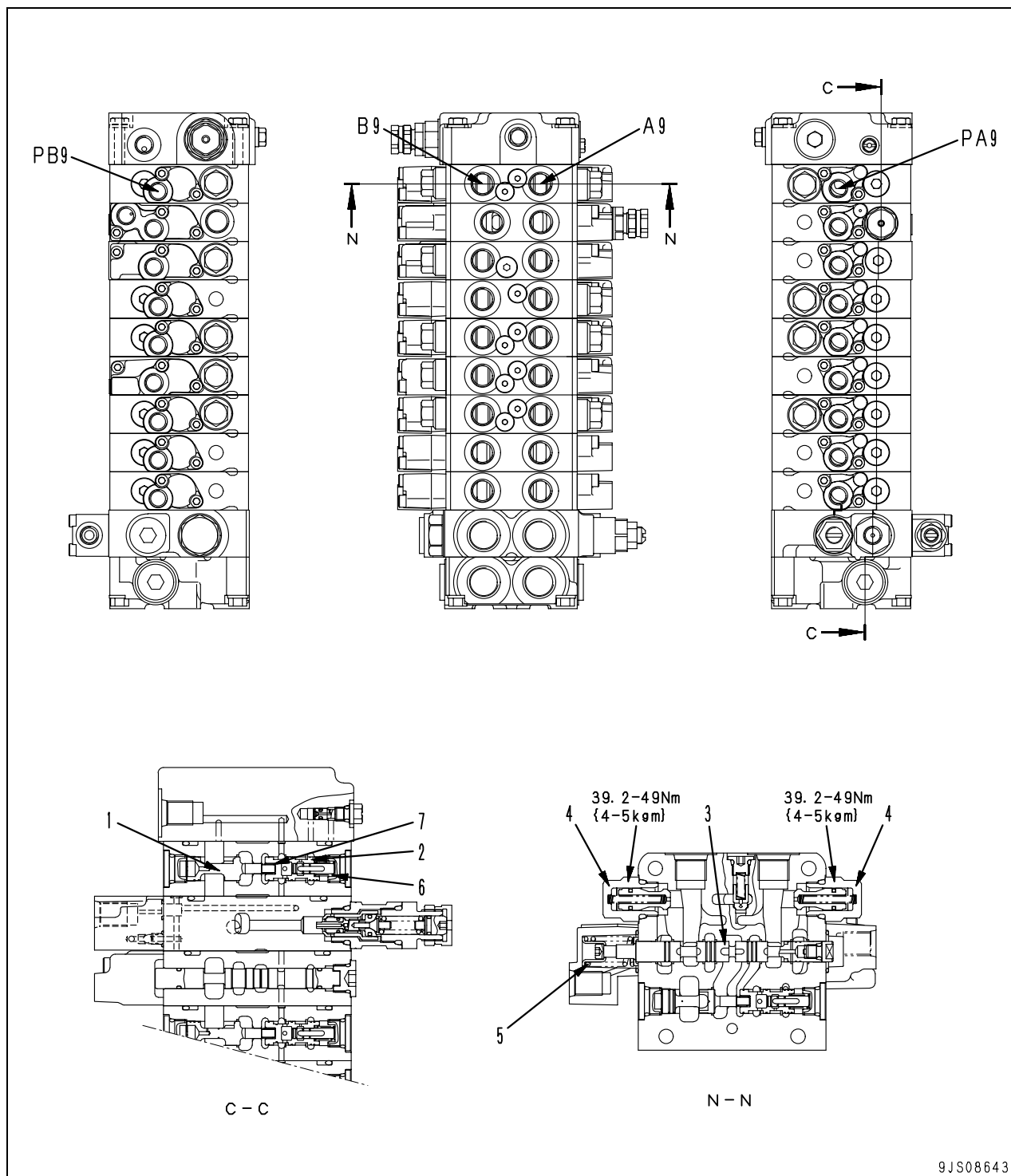
1. Pressure compensation valve F (Arm)
2. Spool (Arm)
3. Suction valve
4. Check valve
5. Pressure compensation valve R (Arm)
6. Pressure compensation valve F (Bucket)
7. Spool (Bucket)
8. Suction valve
9. Check valve
10. Suction valve
11. Pressure compensation valve R (Bucket)
12. Pressure compensation valve F (Boom swing)
13. Spool (Boom swing)
14. Check valve
15. Suction valve
16. Pressure compensation valve R (Boom swing)
17. Spool (Blade)
18. Suction valve
19. Check valve
20. Spool (Swing)
21. Swing relief valve (For gear pump)
22. Safety valve
23. Air bleeding plug

F:Flow control valve

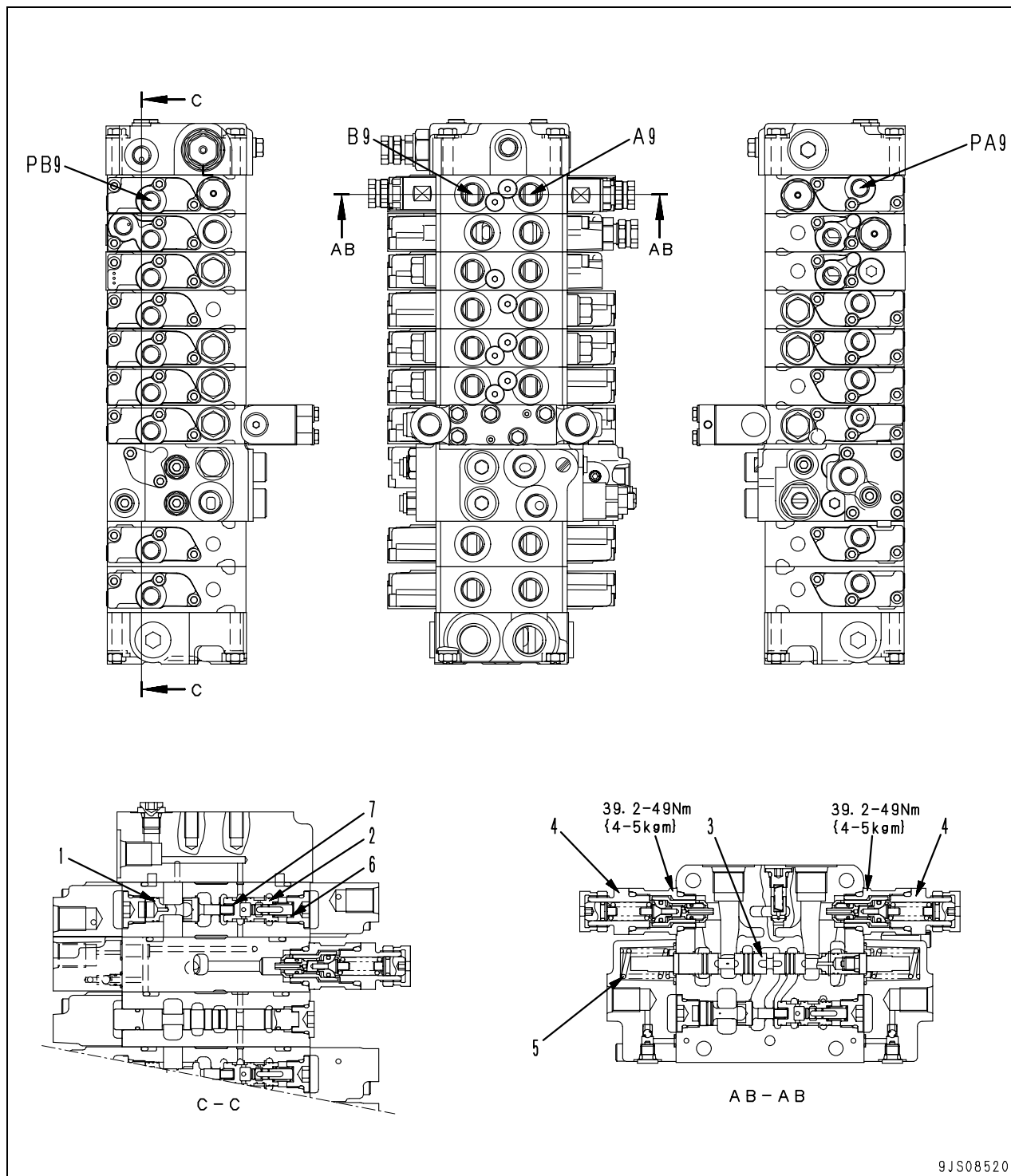
R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
24	Check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		21.9 × 5.0	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	

PC30MR-3 (For KUE)

- ★ This is the 9-spool valve of PC30MR-3 (For KUE), the shape of which, except section N-N, is the same as that of the 9-spool valve of PC30MR-3 (For standard).

2. 9-spool valve**PC35MR-3 (For Standard, North America)**

- ★ This is the 9-spool valve of PC35MR-3 (For standard and North America), the shape of which, except section AB-AB, is the same as that of the 9-spool valve of PC35MR-3 (For standard).

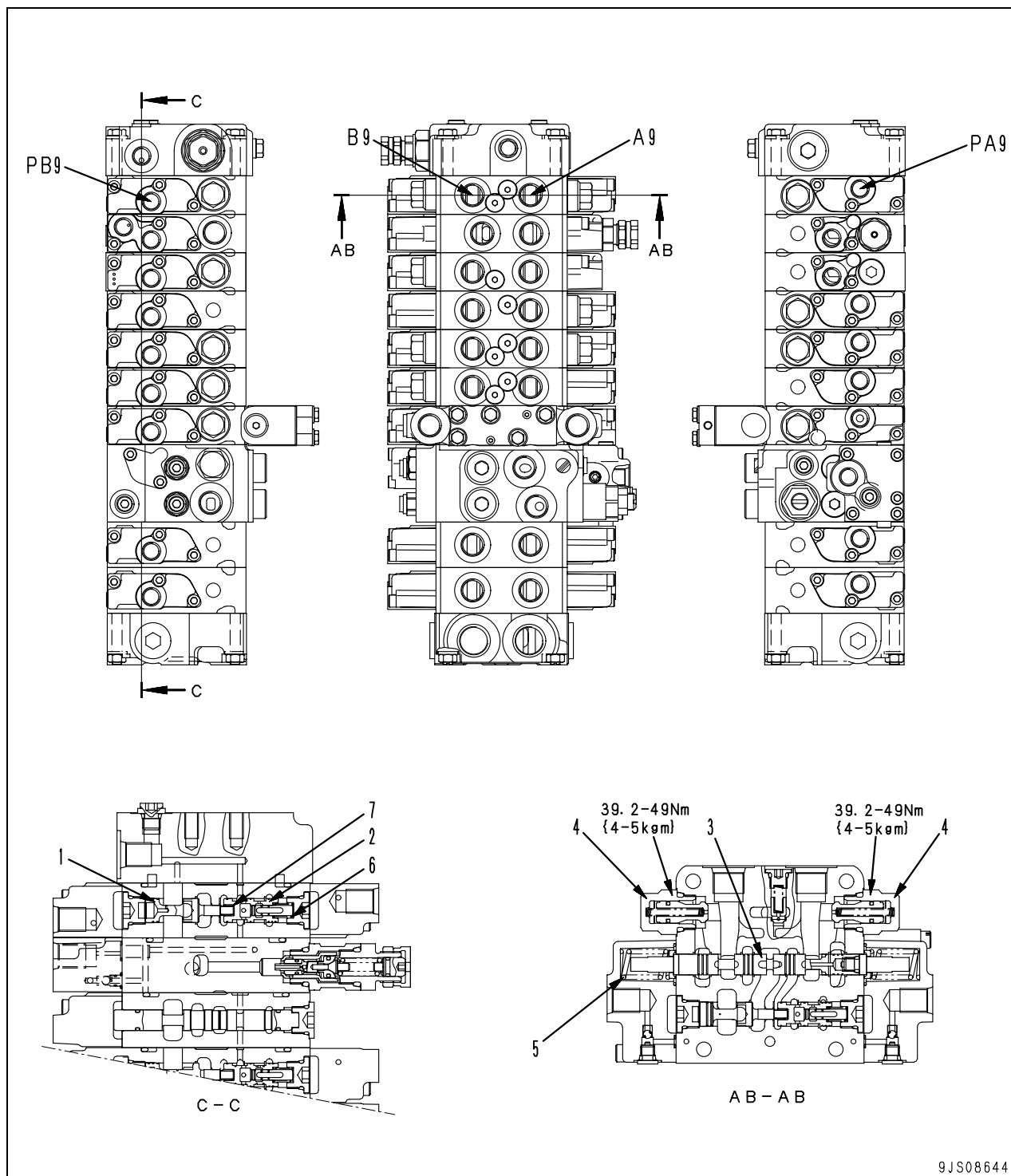
A9 : To stop valve
B9 : To stop valve
PA9 : To attachment PPC valve
PB9 : To attachment PPC valve

1. Pressure compensation valve F (Attachment)
2. Pressure compensation valve R (Attachment)
3. Spool (Attachment)
4. Port relief valve

F:Flow control valve
R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
5	Spool return spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.8 kg}	
6	Pressure compensation valve spring	20.0 × 8.4	12	6.86 N {0.7 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
7	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.78 N {0.61 kg}	

PC35MR-3 (For KUE)

- ★ This is the 9-spool valve of PC35MR-3 (For KUE), the shape of which, except section AB-AB, is the same as that of the 9-spool valve of PC35MR-3 (For standard).

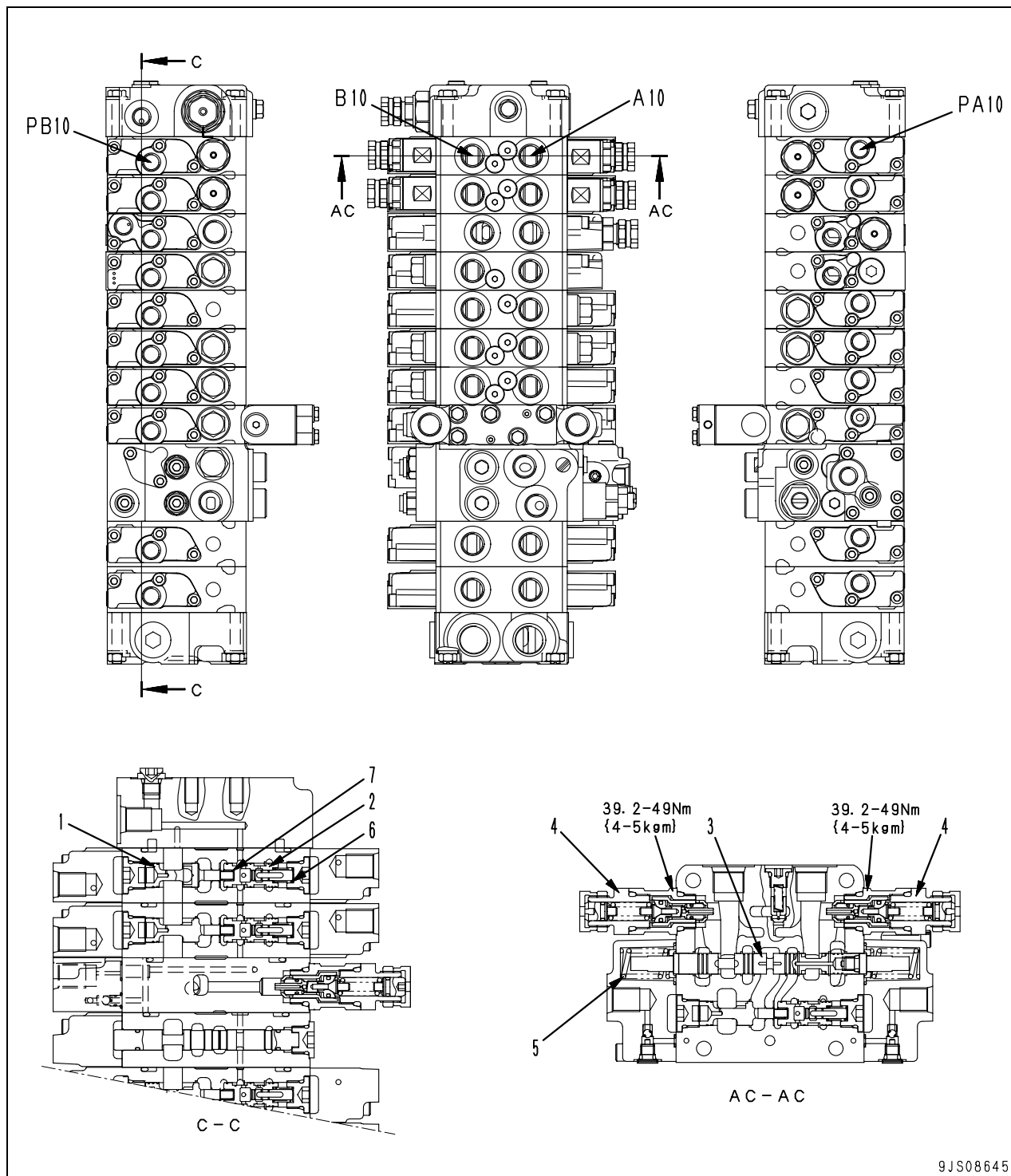
A9 : To stop valve
B9 : To stop valve
PA9 : To attachment PPC valve
PB9 : To attachment PPC valve

1. Pressure compensation valve F (Attachment)
2. Pressure compensation valve R (Attachment)
3. Spool (Attachment)
4. Suction valve

F:Flow control valve
R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
5	Spool return spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.8 kg}	
6	Pressure compensation valve spring	20.0 × 8.4	12	6.86 N {0.7 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
7	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.78 N {0.61 kg}	

3. 10-spool valve**PC35MR-3 (For North America)**

- ★ This is the 10-spool valve of PC35MR-3 (For North America), the shape of which, except section AC-AC, is the same as that of the 9-spool valve of PC35MR-3 (For North America).

A10 : To stop valve to tilt/angle selector valve
B10 : To stop valve to tilt/angle selector valve
PA10 : To PAT PPC valve
PB10 : To PAT PPC valve

1. Pressure compensation valve F (PAT)
2. Pressure compensation valve R (PAT)
3. Spool (PAT)
4. Suction valve

F:Flow control valve

R:Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
5	Spool return spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.8 kg}	
6	Pressure compensation valve spring	20.0 × 8.4	12	6.86 N {0.7 kg}	—	5.49 N {0.56 kg}	Replace spring if damaged or deformed
7	Pressure compensation valve spring	15.4 × 6	8	7.45 N {0.76 kg}	—	5.78 N {0.61 kg}	

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04074-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

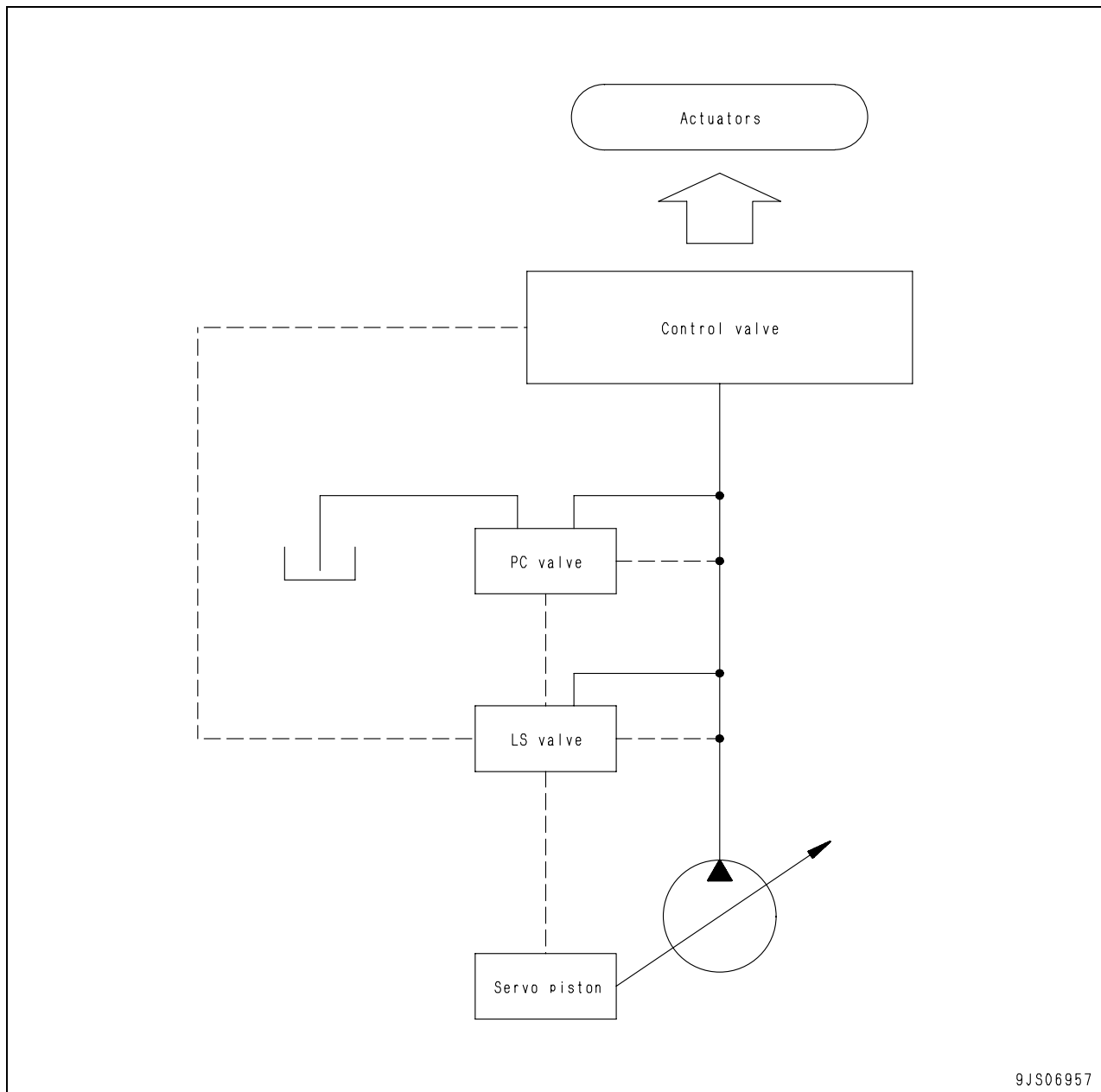
10 Structure, function and maintenance standard

430 Hydraulic system, Part 3

CLSS.....	2
Operation for each function and valve	6
Swing motor	46
PPC valve	51

CLSS

Outline of CLSS



Features

CLSS stands for Closed center Load Sensing System, and has the following features.

- Fine control not influenced by load
- Control enabling digging even with fine control
- Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
- Energy saving using variable pump control

Structure

- The CLSS consists of a variable capacity single piston pump, control valve, and actuators.
- The pump body consists of the main pump, PC valve and LS valve.

1. Control of pump swash plate angle

- ★ For details of the operation, see “Hydraulic pump”.

Swash plate angle (a)

Max.

LS valve set pressure

Min.

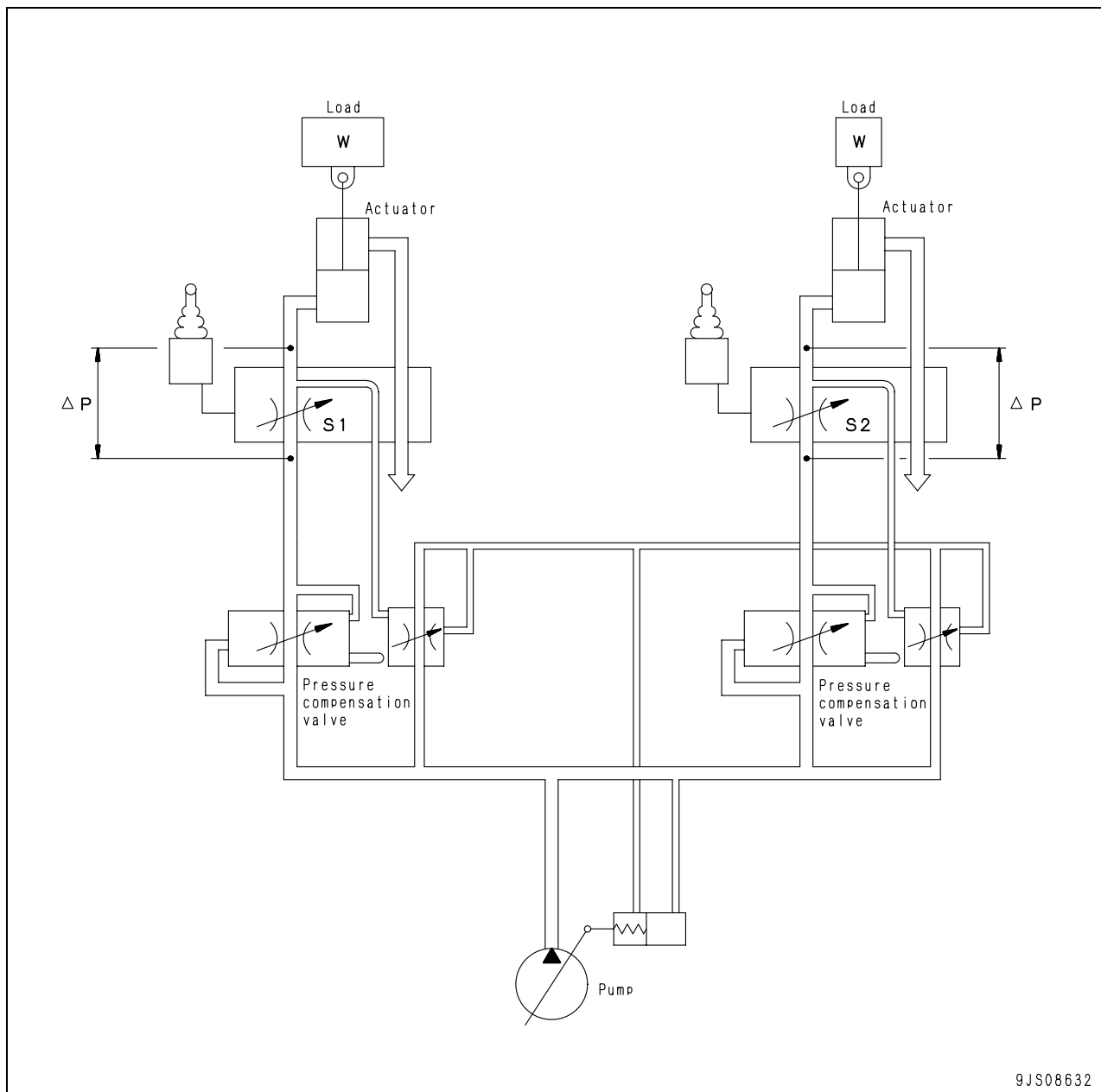
0

LS differential pressure (ΔPLS)

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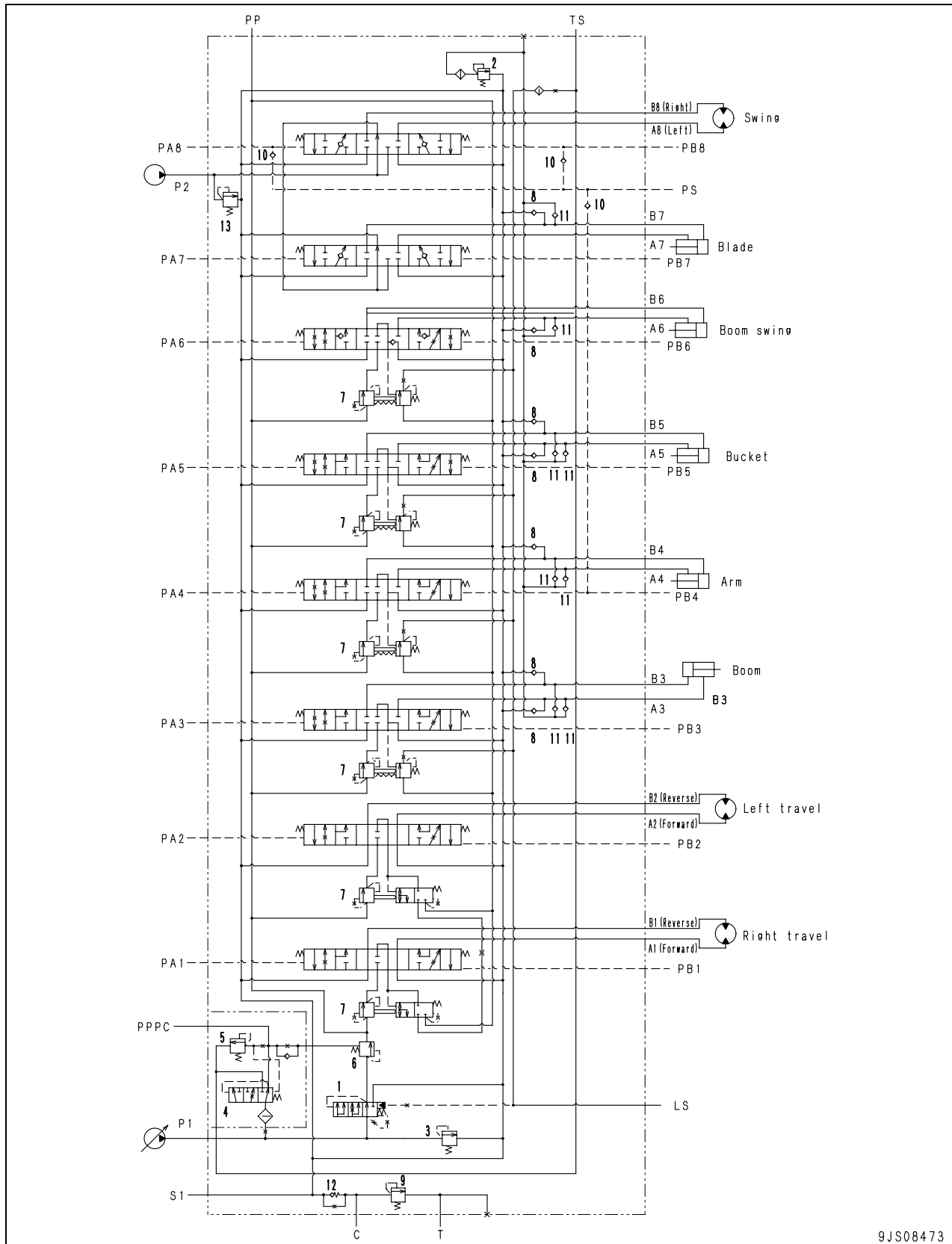
2. Pressure compensation control



- A pressure compensation valve is installed to the outlet port side of the control valve spool to balance the load.
- When two actuators are operated together, this valve acts to make pressure difference (ΔP) between the upstream (inlet port) and downstream (outlet port) the same, regardless of the size of the load (pressure).
- The flow of oil from the pump is divided (compensated) in proportion to the area of openings (S1) and (S2) of each valve when it is operated.

Operation for each function and valve**Hydraulic circuit diagram and name of valve**

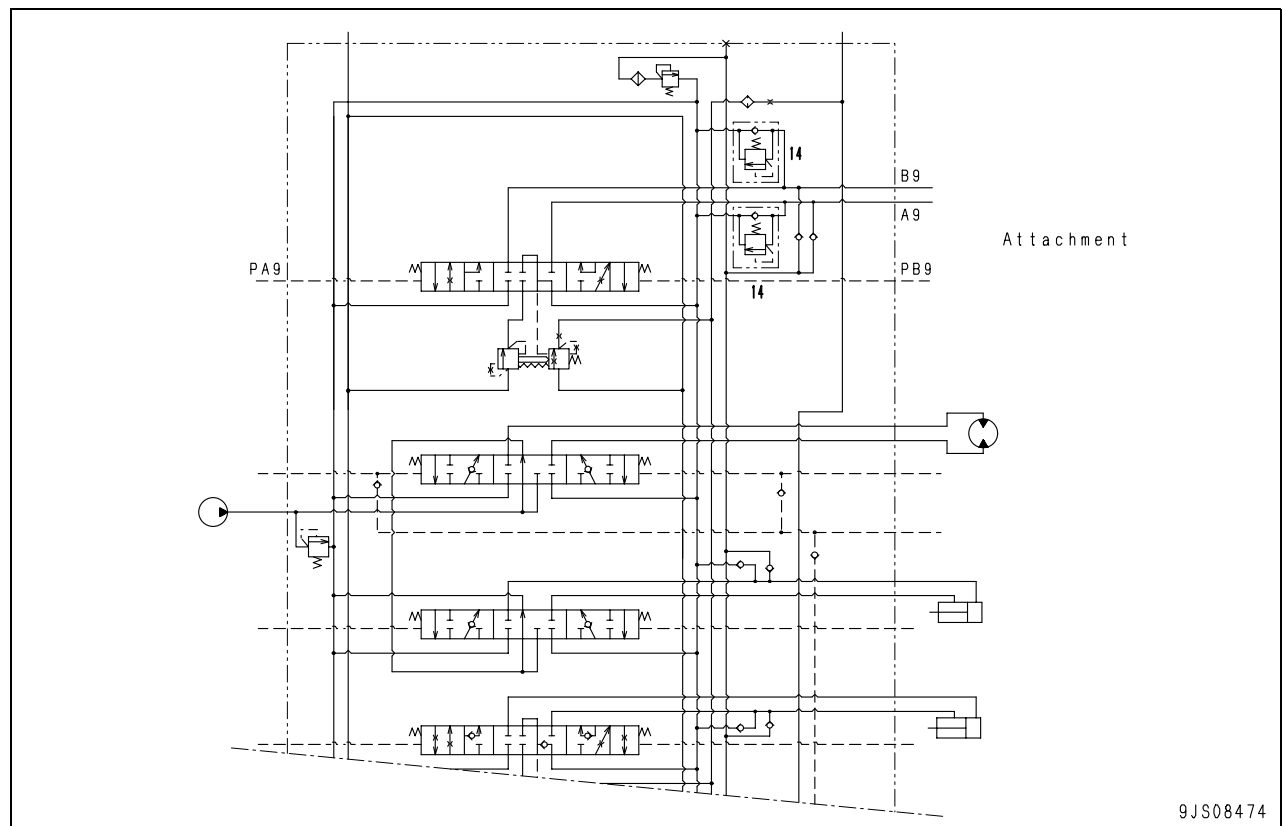
PC27MR-3

**1. 8-spool valve
(For Standard)**

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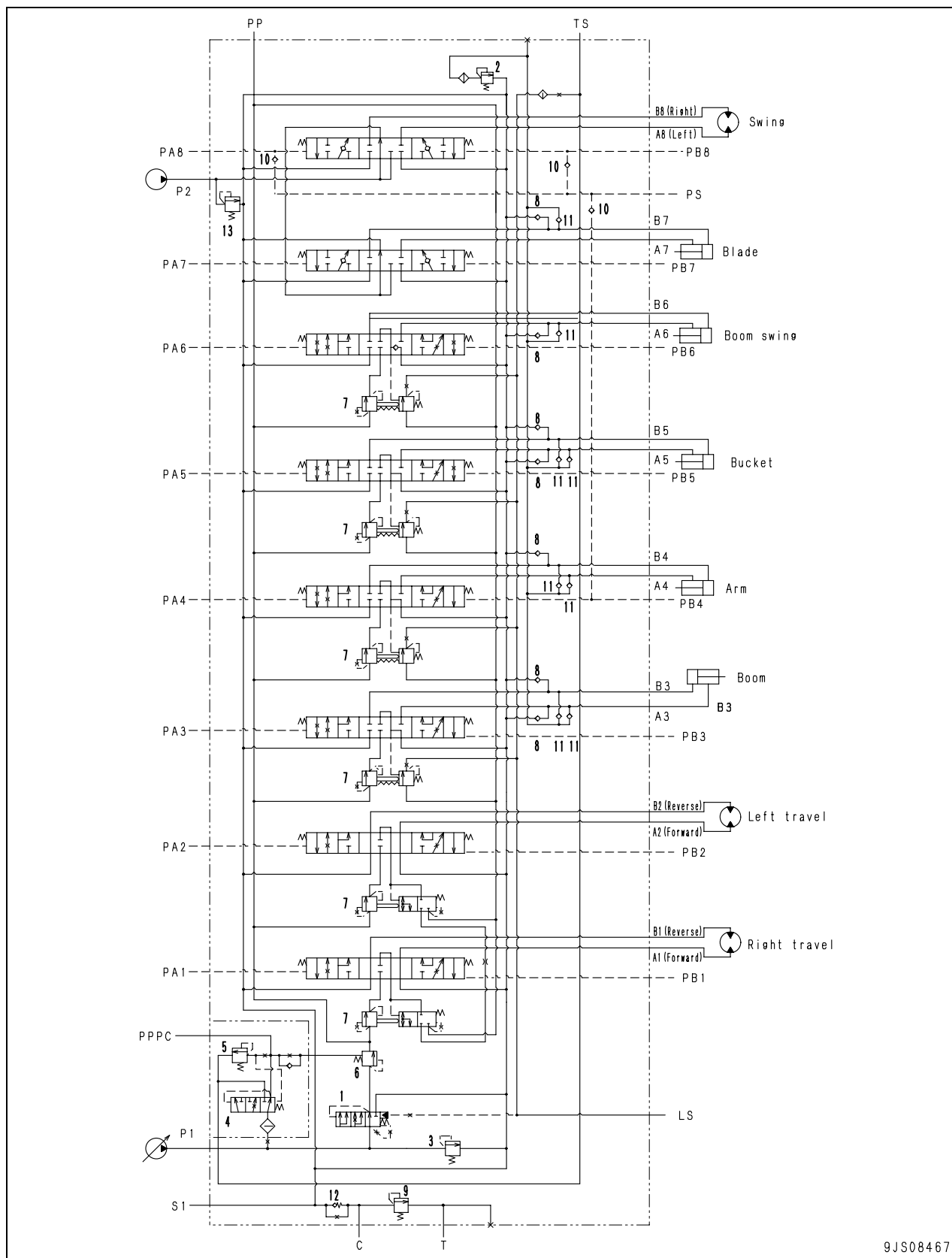
1. Unload valve
Set pressure: LS pressure + 3.70 MPa
{38.0 kg/cm²}
2. Safety valve
Set pressure: 27.9 MPa {285 kg/cm²}
3. Main relief valve
Set pressure: 26.0 MPa {265 kg/cm²}
4. Self pressure reducing valve
5. Pilot relief valve
Set pressure: 2.90 MPa {30.0 kg/cm²}
6. Self pressure sequence valve
Set pressure:
2.90 to 3.40 MPa {30.0 to 35.0 kg/cm²}
7. Pressure compensation valve
8. Suction valve
9. Oil cooler bypass valve
Set pressure: 0.40 MPa {4.0 kg/cm²}
10. Pilot pressure check valve
11. Check valve
12. Back pressure check valve
Set pressure: 0.34 MPa {3.5 kg/cm²}
13. Swing relief valve (for gear pump)
Set pressure: 21.1 MPa {215 kg/cm²}

2. 9-spool valve (For Standard and North America)



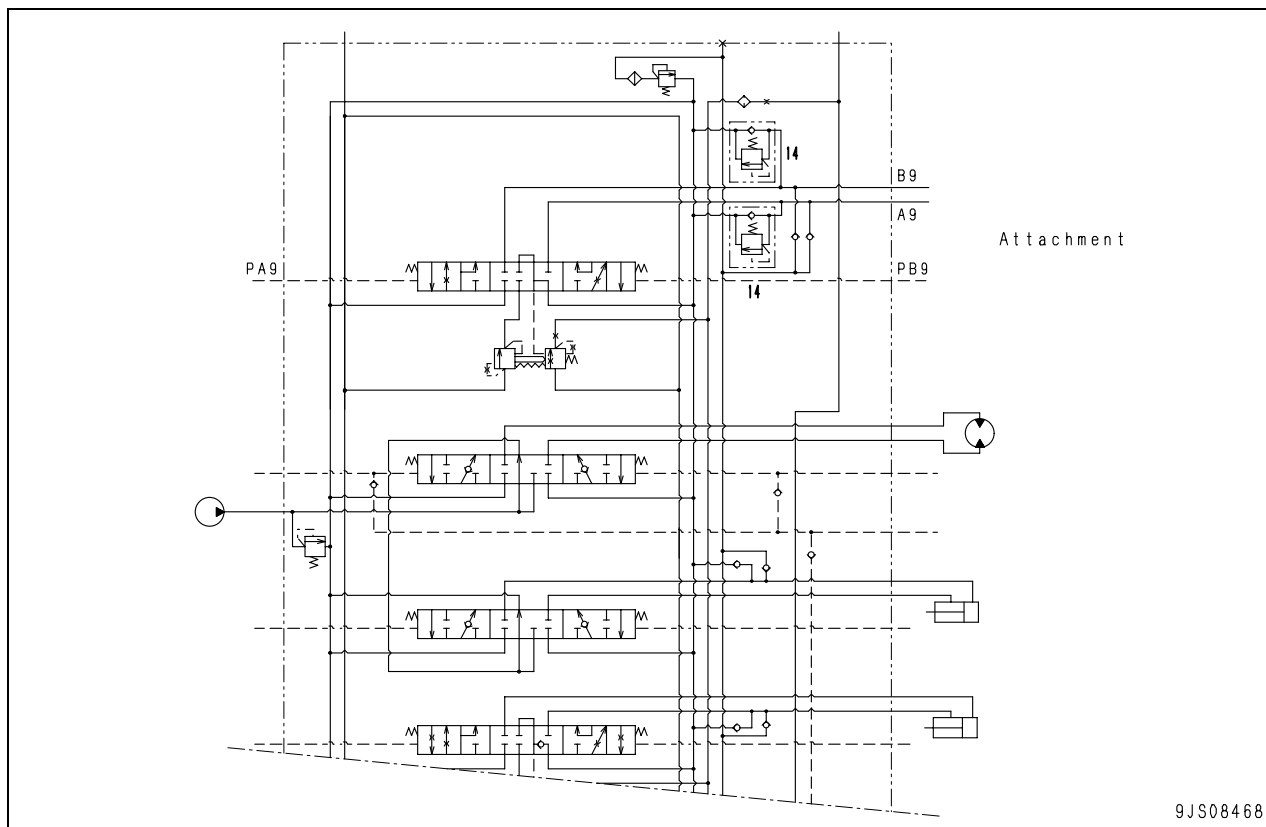
★ As for the hydraulic circuit of the 9-spool valve (For standard and North America) of PC27MR-3, only the parts different from the 8-spool valve (For standard) of PC27MR-3 are shown.

14. Port relief valve
Set pressure: 17.2 MPa {175 kg/cm²}

PC30MR-3**1. 8-spool valve
(For Standard)**

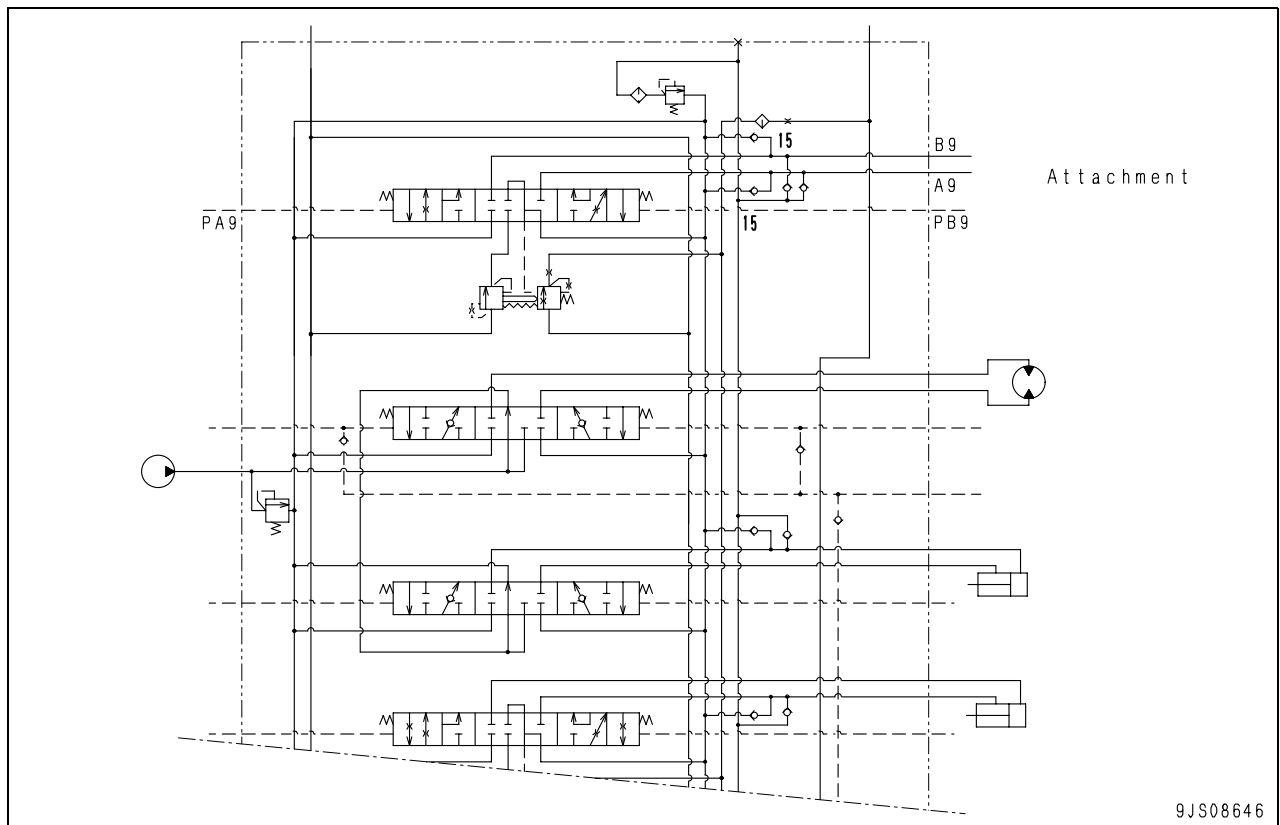
9JS08467

1. Unload valve
Set pressure: LS pressure + 3.70 MPa
{38.0 kg/cm²}
2. Safety valve
Set pressure: 27.9 MPa {285 kg/cm²}
3. Main relief valve
Set pressure: 26.0 MPa {265 kg/cm²}
4. Self pressure reducing valve
5. Pilot relief valve
Set pressure: 2.90 MPa {30.0 kg/cm²}
6. Self pressure sequence valve
Set pressure:
2.90 to 3.40 MPa {30.0 to 35.0 kg/cm²}
7. Pressure compensation valve
8. Suction valve
9. Oil cooler bypass valve
Set pressure: 0.40 MPa {4.0 kg/cm²}
10. Pilot pressure check valve
11. Check valve
12. Back pressure check valve
Set pressure: 0.34 MPa {3.5 kg/cm²}
13. Swing relief valve (for gear pump)
Set pressure: 21.1 MPa {215 kg/cm²}

**2. 9-spool valve
(For Standard)****14. Port relief valve**

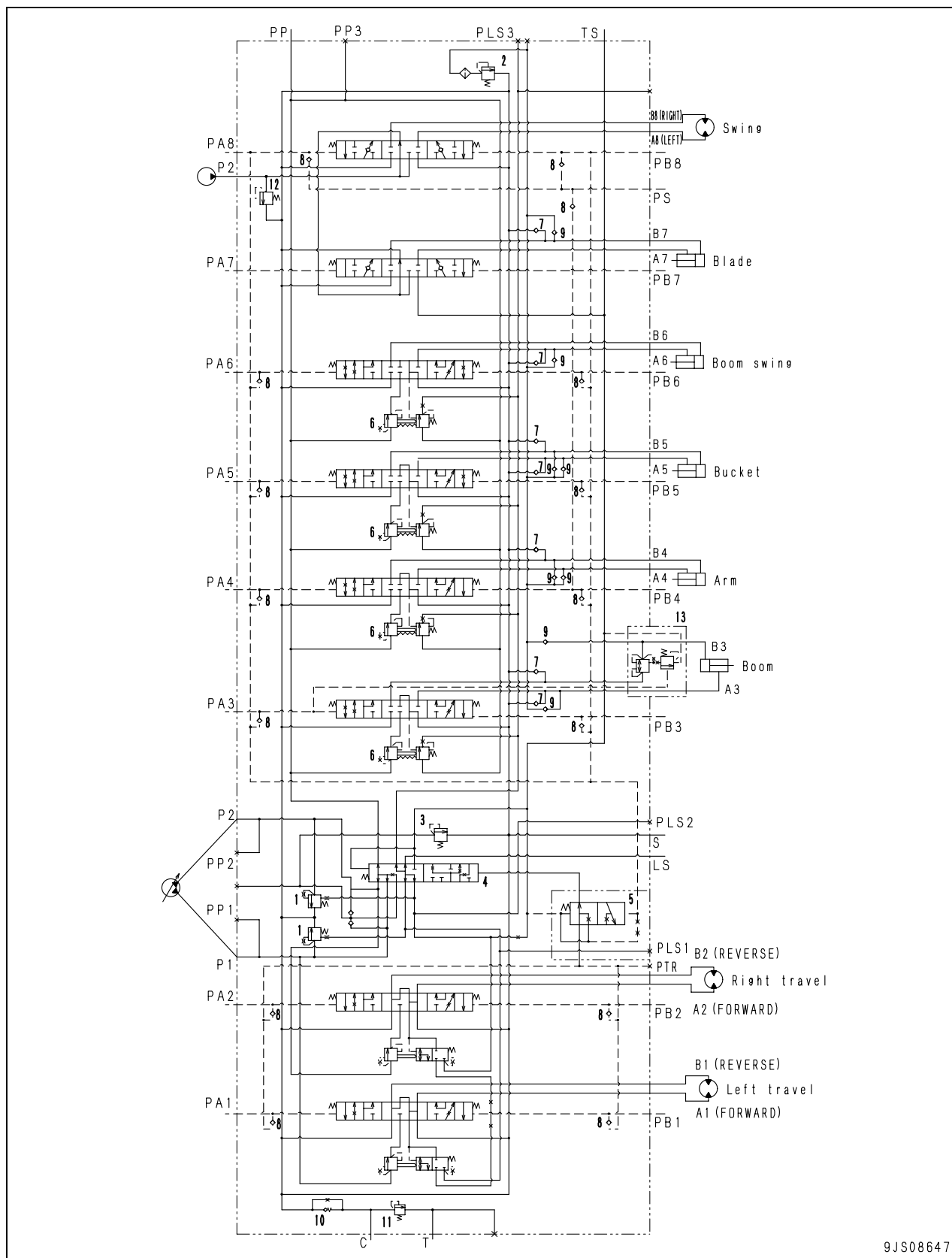
Set pressure: 17.2 MPa {175 kg/cm²}

(For KUE)



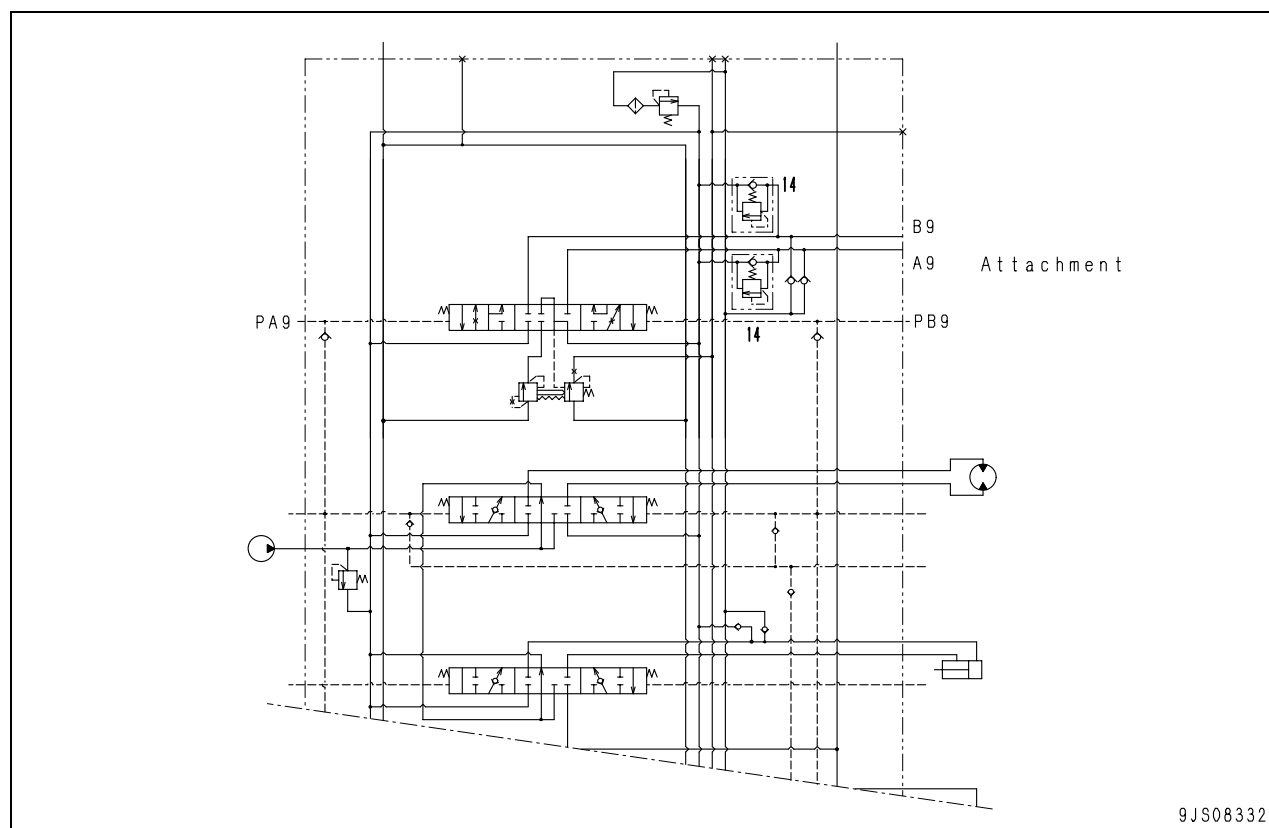
- ★ As for the hydraulic circuit of the 9-spool valve (For standard and KUE) of PC30MR-3, only the parts different from the 8-spool valve (For standard) of PC30MR-3 are shown.

15. Suction valve

PC35MR-3**1. 8-spool valve
(For Standard)**

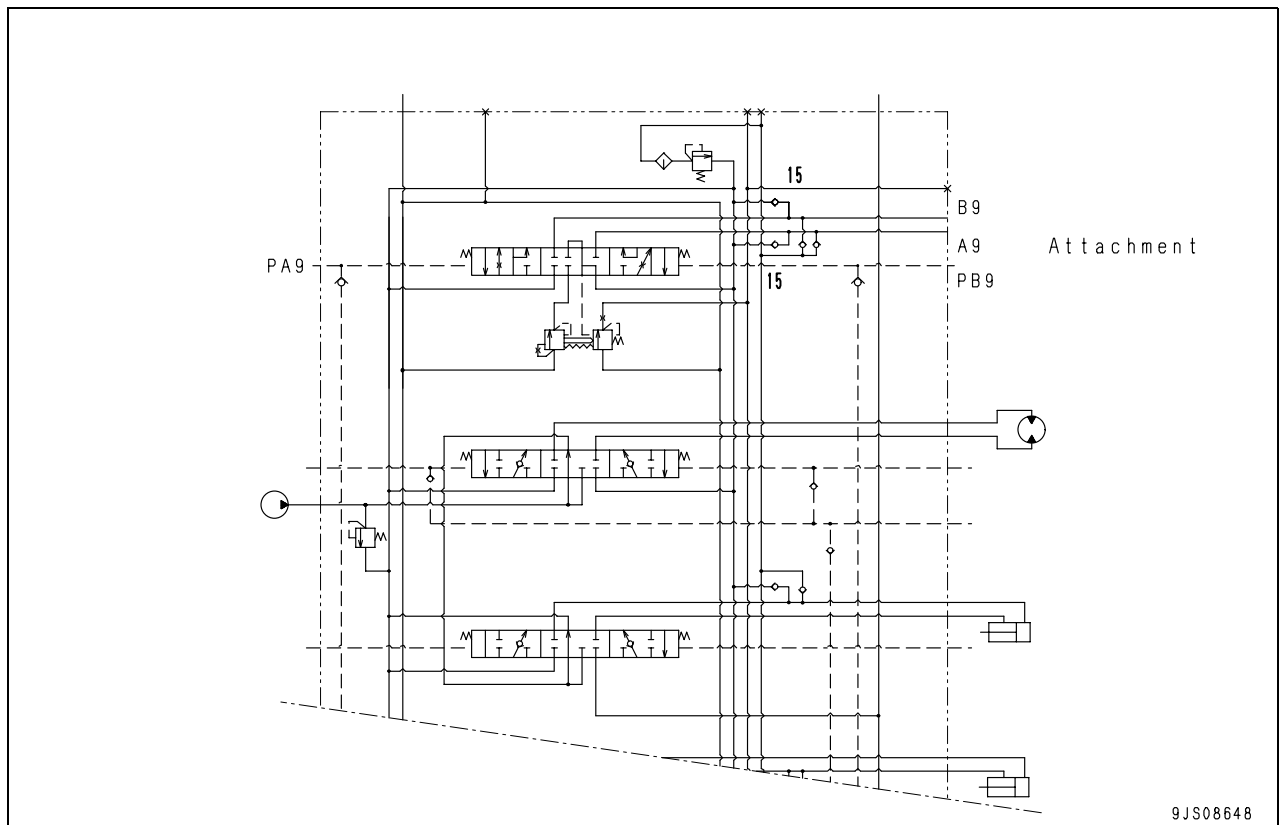
1. Unload valve
Set pressure:
LS pressure + 2.45 MPa {25.0 kg/cm²}
2. Safety valve
Set pressure: 28.0 MPa {285 kg/cm²}
3. Main relief valve
Set pressure: 26.0 MPa {265 kg/cm²}
4. Pump merge-divider valve
5. Logic valve
6. Pressure compensation valve
7. Suction valve
8. Pilot pressure check valve
9. Check valve
10. Back pressure check valve
Set pressure: 0.34 MPa {3.5 kg/cm²}
11. Oil cooler bypass valve
Set pressure: 0.39 MPa {4.0 kg/cm²}
12. Swing relief valve (for gear pump)
Set pressure: 21.6 MPa {220 kg/cm²}
13. Boom lock valve

2. 9-spool valve (For Standard and North America)



14. Port relief valve
(For Standard)
Set pressure: 20.6 MPa {210 kg/cm²}
(For North America)
Set pressure: 17.2 MPa {175 kg/cm²}

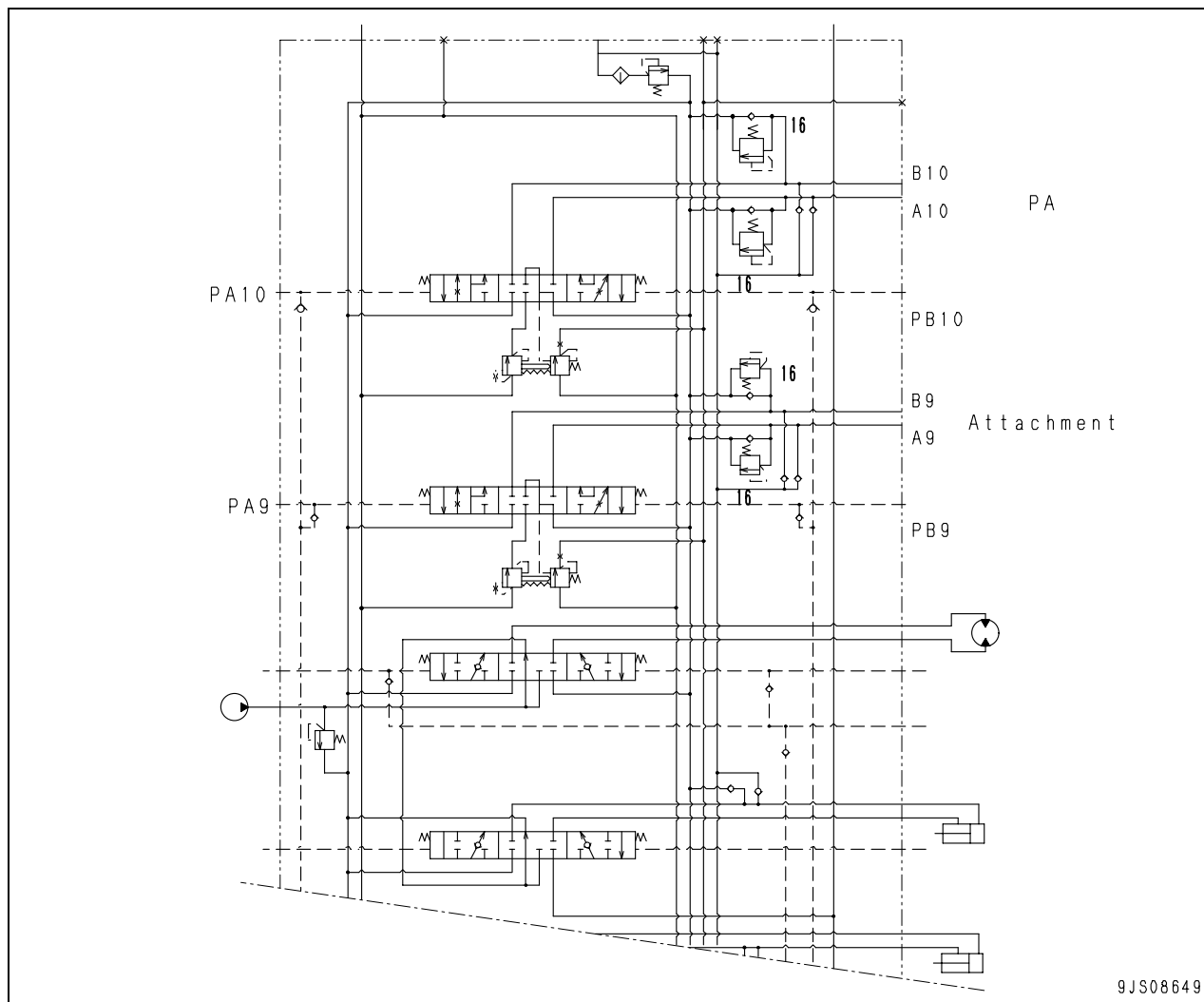
(For KUE)



- ★ As for the hydraulic circuit of the 9-spool valve (For standard, North America and KUE) of PC35MR-3, only the parts different from the 8-spool valve (For standard) of PC35MR-3 are shown.

15. Suction valve

3. 10-spool valve (For North America)

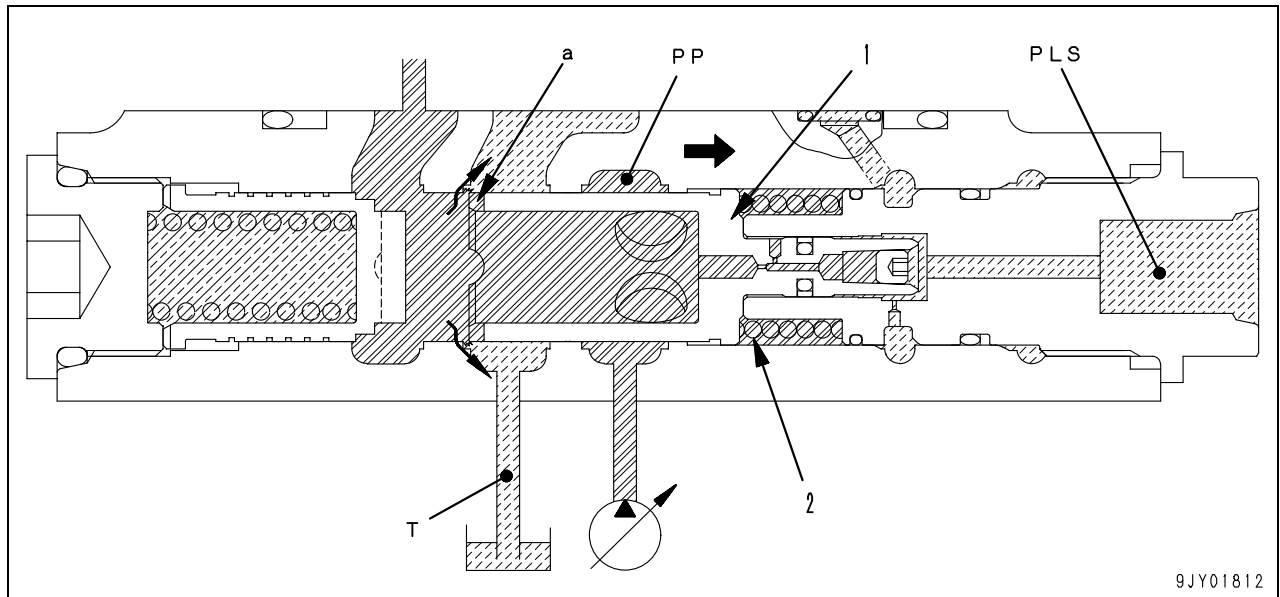


- ★ As for the hydraulic circuit of the 10-spool valve (For North America) of PC35MR-3, only the parts different from the 8-spool valve (For standard) of PC35MR-3 are shown.

16. Port relief valve
Set pressure: 17.2 MPa {175 kg/cm²}

Unload valve PC27MR, 30MR-3

1. When control valve is at neutral



PP : Pump circuit
PLS : LS circuit
T : Tank circuit

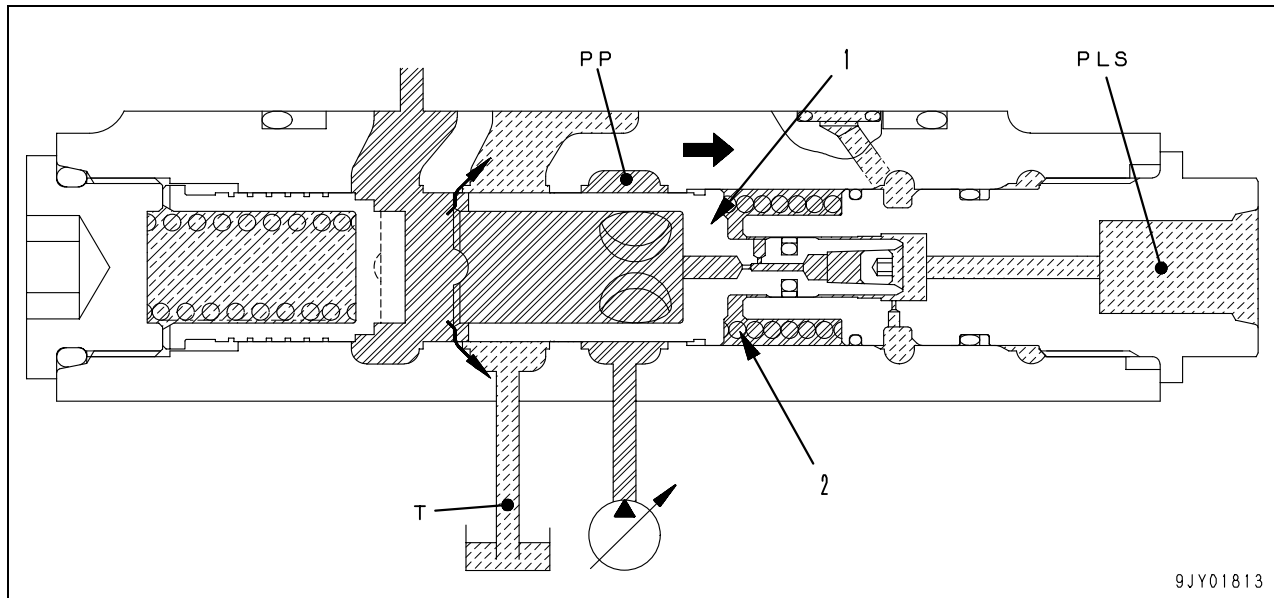
1. Spool
2. Spring

Function

- When the control valve is at neutral, pump delivery (Q) discharged by the minimum swash plate angle is released to the tank circuit. When this happens, pump discharge pressure (PP) is set at 3.43 MPa {35 kg/cm²} by spring (2) inside the valve. (LS pressure (PLS): 0 MPa {0 kg/cm²}).

Operation

- Pump discharge pressure (PP) is acting on the left end of spool (1), and LS pressure (PLS) is acting on the right end.
- When the control valve is at neutral, LS pressure (PLS) is 0, so only pump discharge pressure (PP) has any effect, and (PP) is set only by the load of spring (2).
- As pump discharge pressure (PP) rises and reaches the load of spring (2) (3.43 MPa {35 kg/cm²}), spool (1) is moved to the right in the direction of the arrow. Pump discharge pressure (PP) then passes through the notch (a) of spool (1) and is connected to tank circuit (T).
- In this way, pump discharge pressure (PP) is set to 3.43 MPa {35 kg/cm²}.

2. When control valve is in fine control

PP : Pump circuit

PLS : LS circuit

T : Tank circuit

1. Spool
2. Spring

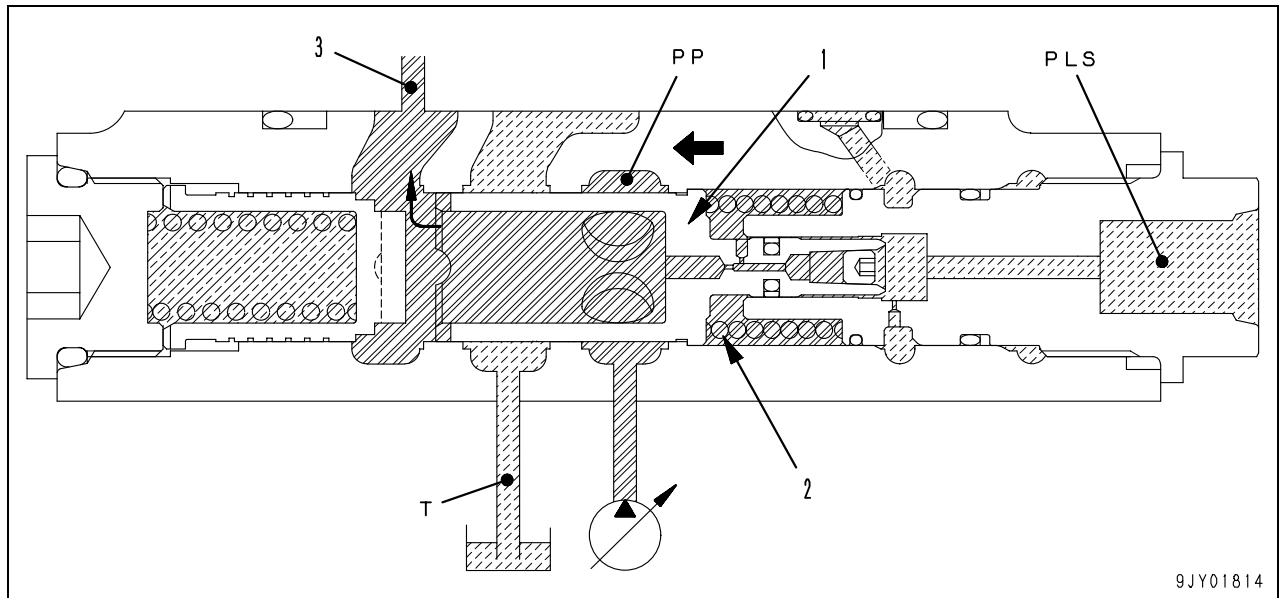
Function

- When the control valve is in the fine control mode, if the demand flow for actuator is less than the value corresponding to the minimum swash plate angle of the pump, pump pressure (PP) is set to LS pressure (PLS) + 3.43 MPa {35.0 kg/cm²}. If the difference pressure between pump pressure (PP) and LS pressure (PLS) becomes equal to the load of spring (2) (3.43 MPa {35.0 kg/cm²}), the unload valve opens. Accordingly, LS differential pressure (Δ PLS) is (3.43 MPa {35.0 kg/cm²}) at this time.

Operation

- When fine control is carried out on the control valve, LS pressure (PLS) is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure (PLS) and pump discharge pressure (PP).
- When the differential pressure between pump discharge pressure (PP) and LS pressure (PLS) reaches the load of spring (2) (3.43MPa {35 kg/cm²}), spool (1) moves to the right in the direction of the arrow, and pump circuit (PP) and tank circuit (T) are connected.
- In other words, pump discharge pressure (PP) is set to a pressure equal to the spring force (3.43 MPa {35 kg/cm²}) + LS pressure (PLS), and LS differential pressure (Δ PLS) becomes 3.43 MPa {35 kg/cm²}.

3. When control valve is being operated (work equipment)



PP : Pump circuit
PLS : LS circuit
T : Tank circuit

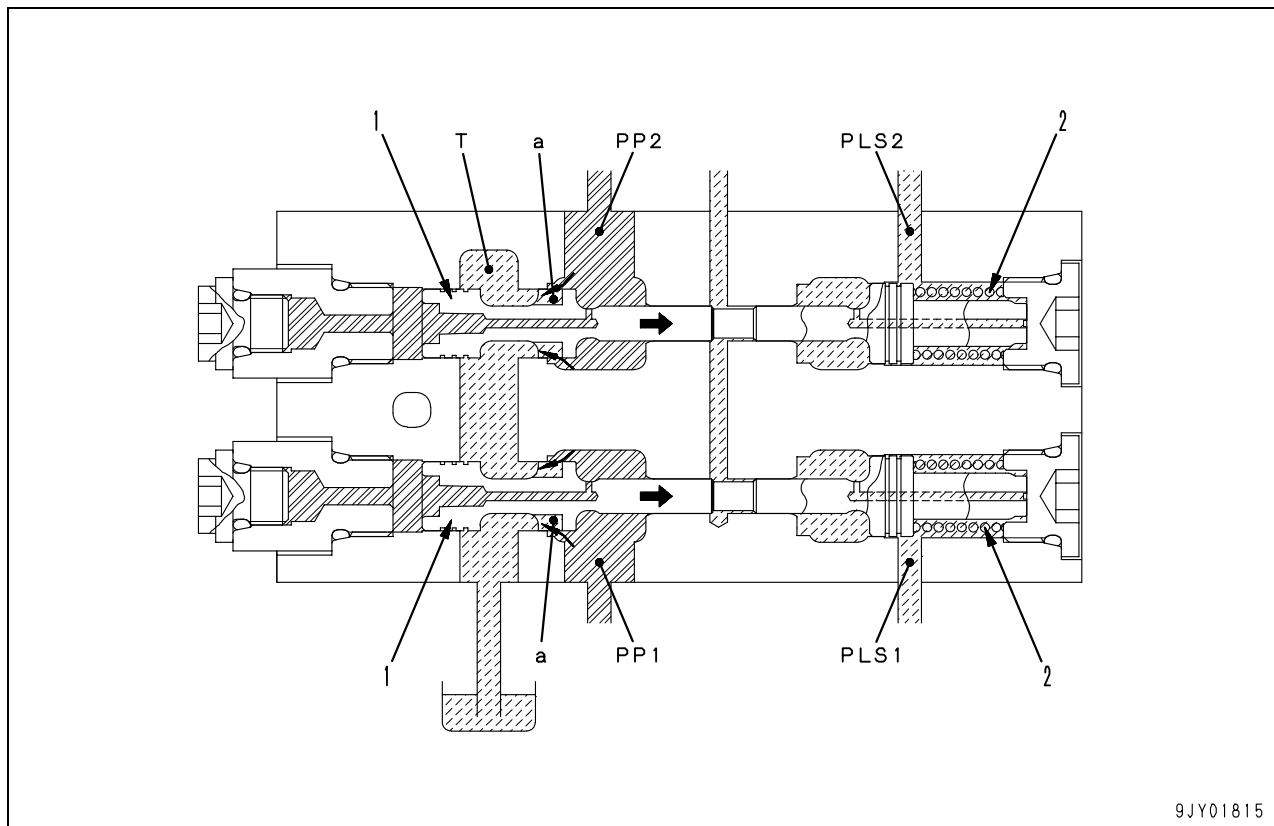
1. Spool
2. Spring
3. Actuator circuit

Function

- When the control valve is operated, if the demand flow for actuator exceeds the value corresponding to the minimum swash plate angle of the pump, the outflow to tank circuit (T) is shut off and all of pump delivery (Q) is sent to the actuator circuit.

Operation

- When the control valve is operated to a bigger stroke, LS pressure (PLS) is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure (PLS) and pump discharge pressure (PP) is small.
- For this reason, the differential pressure between pump discharge pressure (PP) and LS pressure (PLS) does not reach the load of spring (2) (3.43 MPa {35 kg/cm²}), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit (PP) and tank circuit (T) are shut off, and all the pump delivery (Q) flows to the actuator circuit (3).

PC35MR-3**1. When control valve is at neutral**

PP1, PP2 : Pump circuit

PLS1, PLS2 : LS circuit

T : Tank circuit

1. Spool
2. Spring

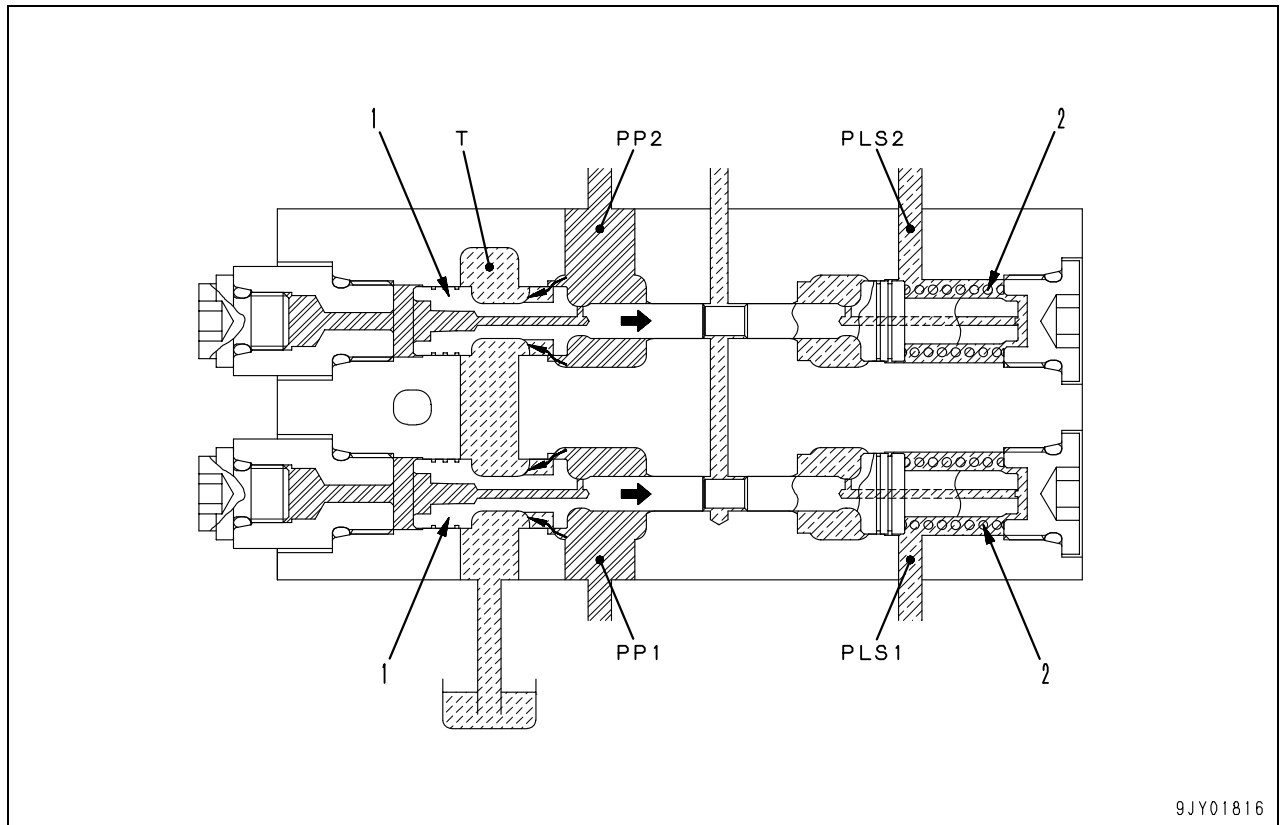
Function

- When the control valve is at neutral, pump delivery (Q) discharged by the minimum swash plate angle is released to the tank circuit. When this happens, pump discharge pressure (PP1), (PP2) is set at 2.45 MPa {25.0 kg/cm²} by spring (2) inside the valve. [LS pressure (PLS1), (PLS2): 0 MPa {0 kg/cm²}]

Operation

- Pump discharge pressure (PP1), (PP2) is acting on the left end of spool (1), and LS pressure (PLS1), (PLS2) is acting on the right end.
- When the control valve is at neutral, LS pressure (PLS1), (PLS2) is 0, so only pump discharge pressure (PP1), (PP2) has any effect, and (PP1), (PP2) is set only by the load of spring (2).
- As pump discharge pressure (PP1), (PP2) rises and reaches the load of spring (2) (2.45 MPa {25.0 kg/cm²}), spool (1) is moved to the right in the direction of the arrow. Pump discharge pressure (PP1), (PP2) then passes through the notch (a) in spool (1) and is connected to tank circuit (T).
- In this way, pump discharge pressure (PP1), (PP2) is set to 2.45 MPa {25.0 kg/cm²}.

2. When control valve is in fine control



PP1, PP2 : Pump circuit
PLS1, PLS2 : LS circuit
T : Tank circuit

1. Spool
2. Spring

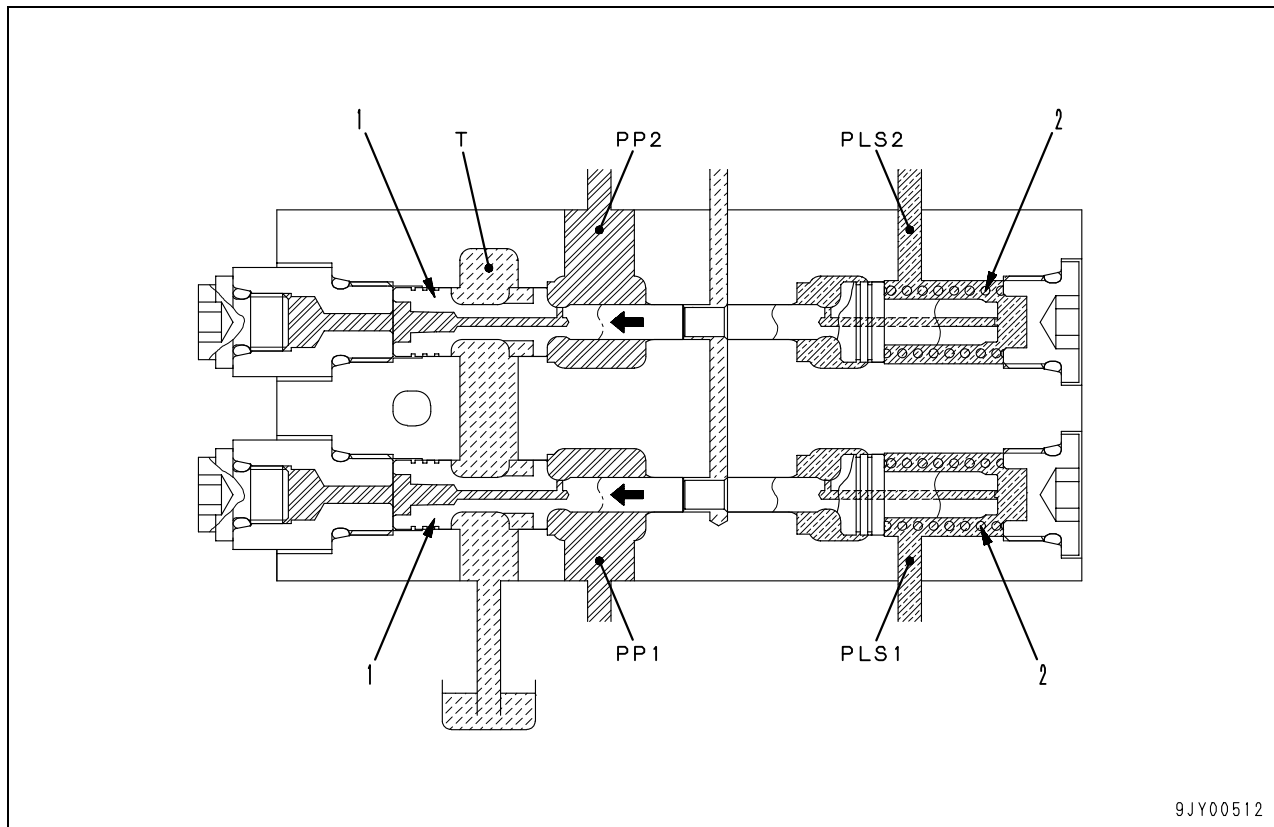
Function

- When the control valve is in the fine control mode, if the demand flow for actuator is less than the value corresponding to the minimum swash plate angle of the pump, pump pressure (PP1), (PP2) is set to LS pressure (PLS1), (PLS2) + 2.45 MPa {25.0 kg/cm²}. If the differential pressure between pump pressure (PP1), (PP2) and LS pressure (PLS1), (PLS2) becomes equal to the load of spring (2) (2.45 MPa {25.0 kg/cm²}), the unload valve opens. Accordingly, LS differential pressure (PLS) is 2.45 MPa {25.0 kg/cm²} at this time.

Operation

- When fine control is carried out on the control valve, LS pressure (PLS1), (PLS2) is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure (PLS1), (PLS2) and pump discharge pressure (PP1), (PP2).
- When the differential pressure between pump discharge pressure (PP1), (PP2) and LS pressure (PLS1), (PLS2) reaches the load of spring (2) (2.45 MPa {25.0 kg/cm²}), spool (1) moves to the right in the direction of the arrow, and pump circuit (PP1), (PP2) and tank circuit (T) are connected.
- In other words, pump discharge pressure (PP1), (PP2) is set to a pressure equal to the spring force (2.45 MPa {25.0 kg/cm²}) + LS pressure (PLS1), (PLS2) and LS differential pressure (Δ PLS) becomes 2.45 MPa {25.0 kg/cm²}.

3. When control valve is being operated (work equipment)



PP1, PP2 : Pump circuit
 PLS1, PLS2 : LS circuit
 T : Tank circuit

1. Spool
2. Spring

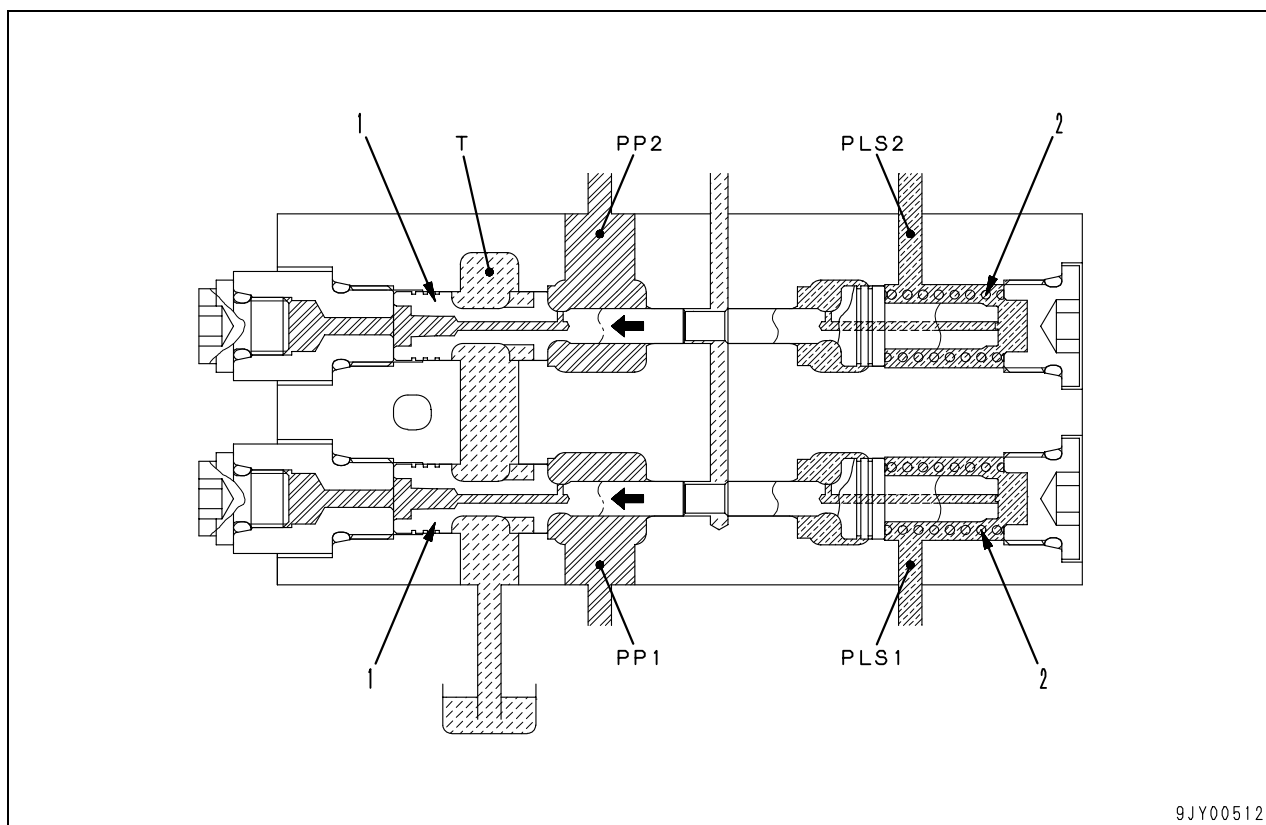
Function

- When the control valve is operated, if the demand flow for actuator exceeds the value corresponding to the minimum swash plate angle of the pump, the outflow to tank circuit (T) is shut off and all of pump delivery (Q1), (Q2) is sent to the actuator circuit.

Operation

- When the control valve is operated to a bigger stroke, LS pressure (PLS1), (PLS2) is generated and acts on the right end of spool (1). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure (PLS1), (PLS2) and pump discharge pressure (PP1), (PP2) is small.
- For this reason, the differential pressure between pump discharge pressure (PP1), (PP2) and LS pressure (PLS1), (PLS2) does not reach the load of spring (2) (2.45 MPa {25.0 kg/cm²}), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit (PP1), (PP2) and tank circuit (T) are shut off, and all the pump delivery (Q1), (Q2) flows to the actuator circuit.

4. When travel control valve is operated (singly)



PP1, PP2 : Pump circuit
PLS1, PLS2 : LS circuit
T : Tank circuit

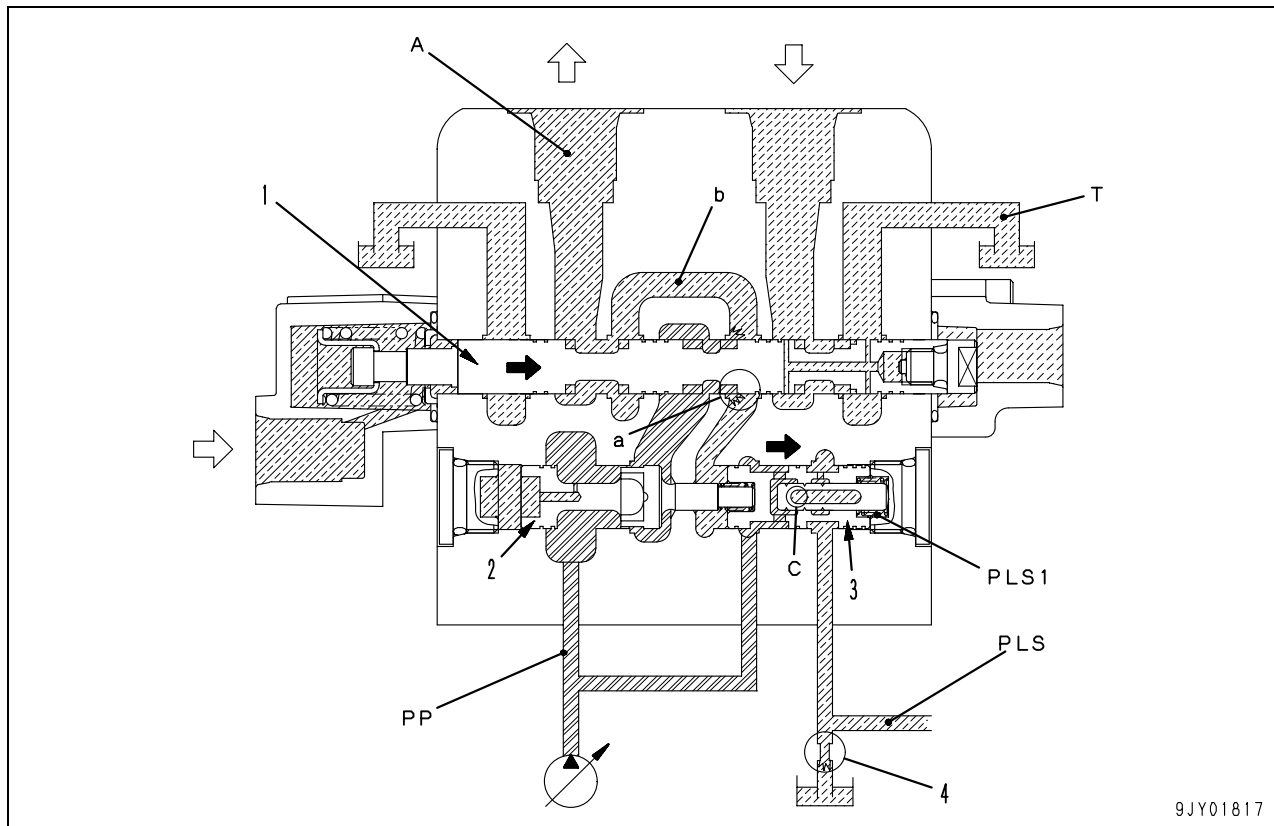
1. Spool
2. Spring

Function

- When the machine travels, the swash plate angle of the pump becomes maximum. At this time, the oil flow is controlled according to the opening rate of the spool (1).

Operation

- When the travel control valve is operated singly, the control valve is separated by the pump merge-diver valve.
- As a result, the unload valves on (PP1) and (PP2) sides operate according to the opening rate of the travel spools (1) on both sides.

Introduction of LS pressure**PC27MR, 30MR-3****1. Work equipment valve (Boom, arm, bucket, boom swing, travel)**

9JY01817

Function

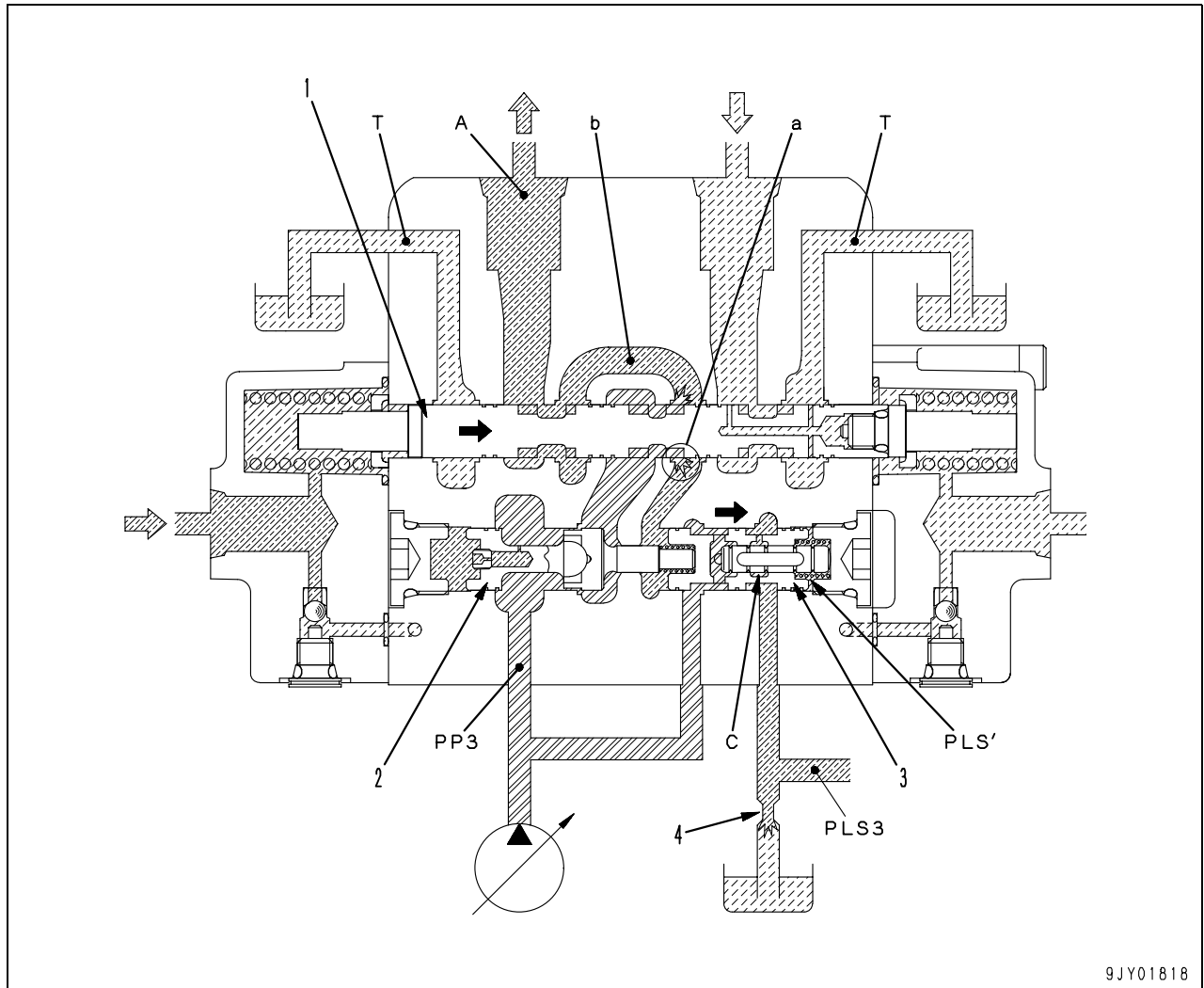
- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- With the control valve, it actually reduces pump pressure (PP) at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure (A), and sends it to the LS circuit (PLS).

Operation

- When spool (1) is operated, pump pressure (PP) flows from flow control valve (2) and notch (a) in the spool through bridge passage (b) to actuator circuit (A).
- At the same time, reducing valve (3) also moves to the right, so pump pressure (PP) is reduced by the pressure loss at notch (c), and then applied through LS circuit (PLS) to spring chamber (PLS1).
- When this happens, LS circuit (PLS) is connected to tank circuit (T) from LS bypass plug (4) (see the section on the LS bypass plug).
- The actuator circuit pressure (A) acts on the left end of reducing valve (3). The reduced pump pressure (PP) acts on at the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure (A) and the pressure of spring chamber (PLS1) are the same. Pump pressure (PP) reduced at notch (a) becomes actuator circuit pressure (A) and is taken to LS circuit (PLS).

PC35MR-3

1. Work equipment valve (Boom, arm, bucket, boom swing)



9JY01818

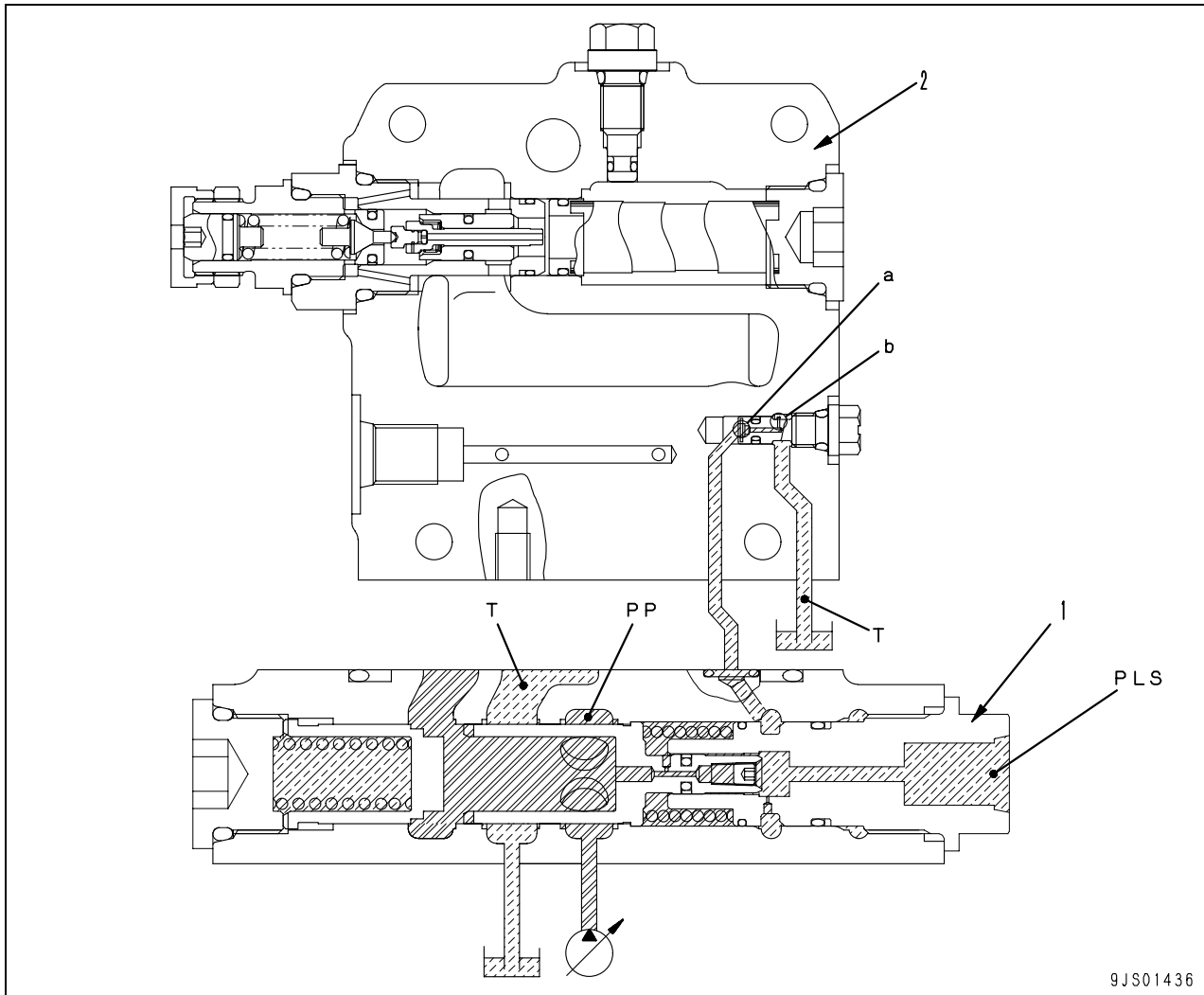
Function

- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- With the control valve, it actually reduces pump pressure (PP3) at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure (A), and sends it to the LS circuit (PLS3).

Operation

- When spool (1) is operated, pump pressure (PP3) flows from flow control valve (2) and notch (a) in the spool through bridge passage (b) to actuator circuit (A).

- At the same time, reducing valve (3) also moves to the right, so pump pressure (PP3) is reduced by the pressure loss at notch (c). It goes to LS circuit (PLS3), and then goes to spring chamber (PLS').
- When this happens, LS circuit (PLS3) is connected to tank circuit (T) from LS bypass valve (4) (see the section on the LS bypass valve).
- The actuator circuit pressure (A) acts on the left end of reducing valve (3). The reduced pump pressure (PP3) acts on the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure (A) and the pressure of spring chamber (PLS') are the same. Pump pressure (PP3) reduced at notch (a) becomes actuator circuit pressure (A) and is taken to LS circuit (PLS3).

LS bypass valve
PC27MR, PC30MR-3

9JS01436

PLS : LS circuit
T : Tank circuit

1. LS bypass valve
2. Valve cover

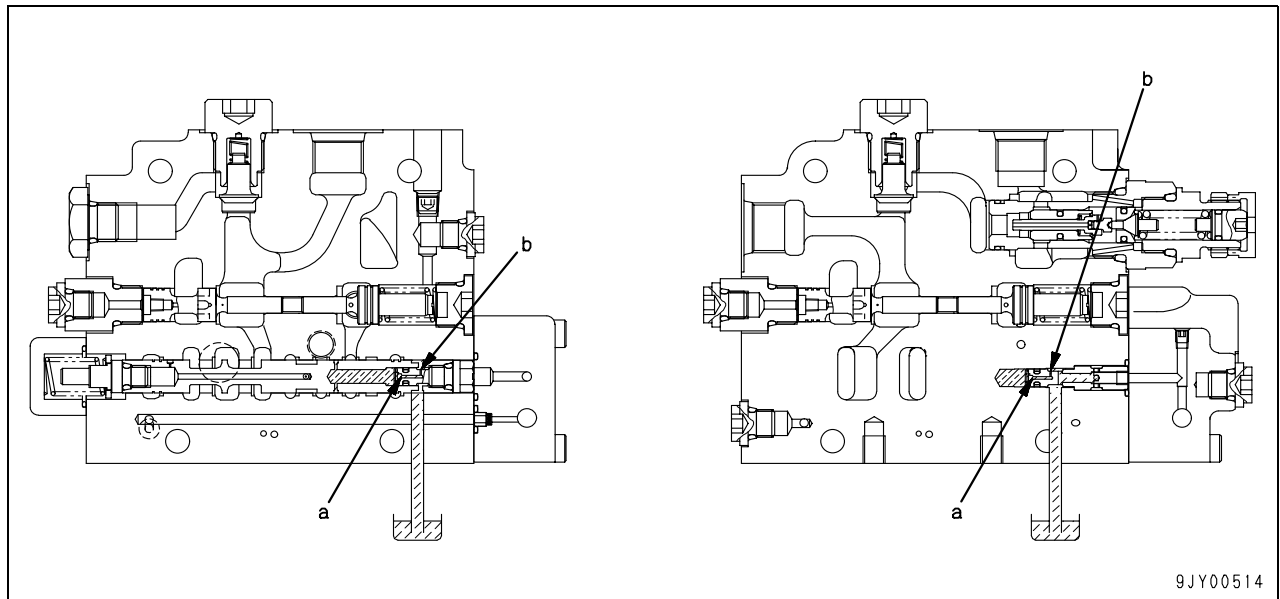
Function

- This releases the residual pressure of LS pressure (PLS).
- It makes the speed of the rise in pressure of LS pressure (PLS) more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.

Operation

- The pressurized oil for LS circuit (PLS) passes from filter (a) of bypass valve (1) through orifice (b) and flows to the tank circuit (T).

PC35MR-3



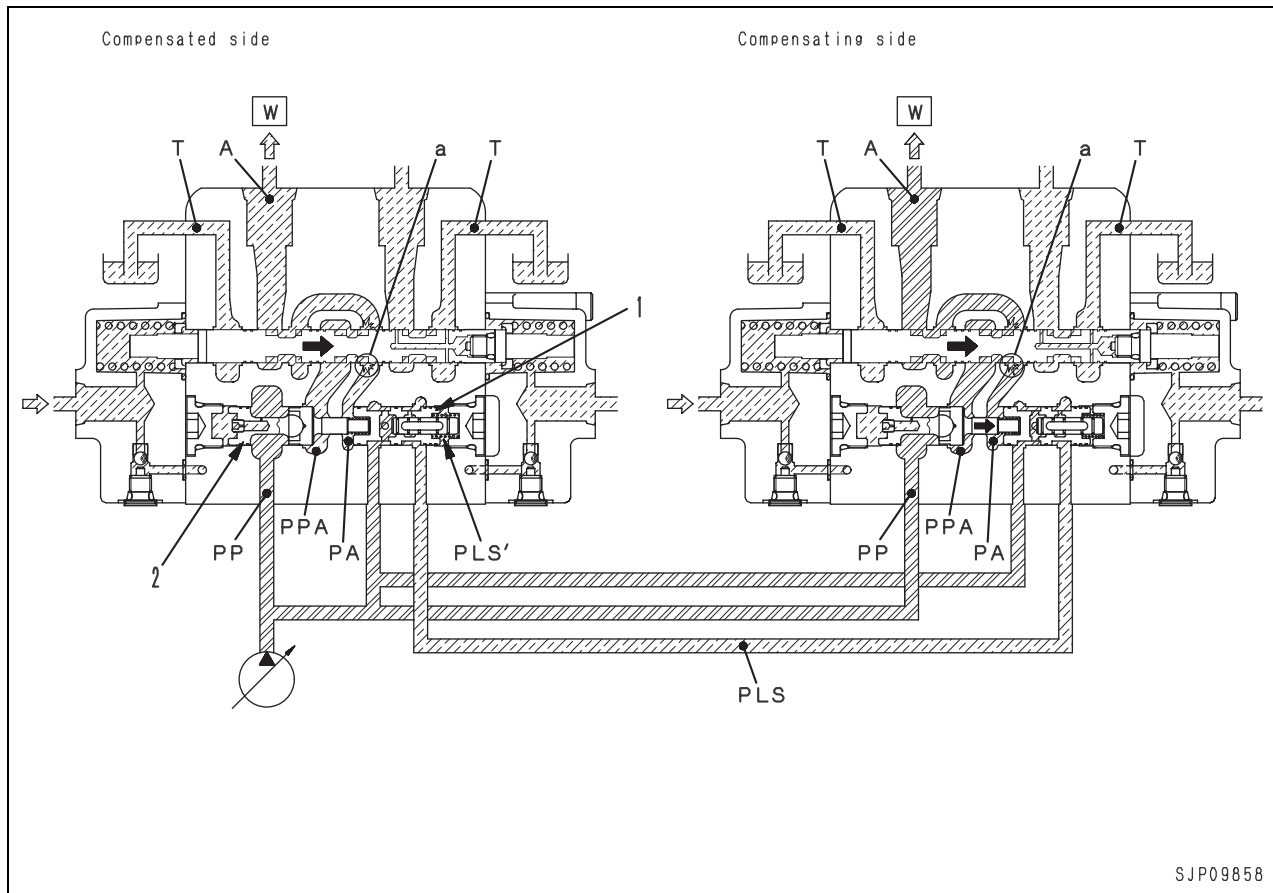
Function

- This releases the residual pressure of LS pressure.
- It makes the speed of the rise in pressure of LS pressure more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.

Operation

- The oil in LS circuit flows through filter (a) and orifice (b) to the tank circuit.

Pressure compensation valve



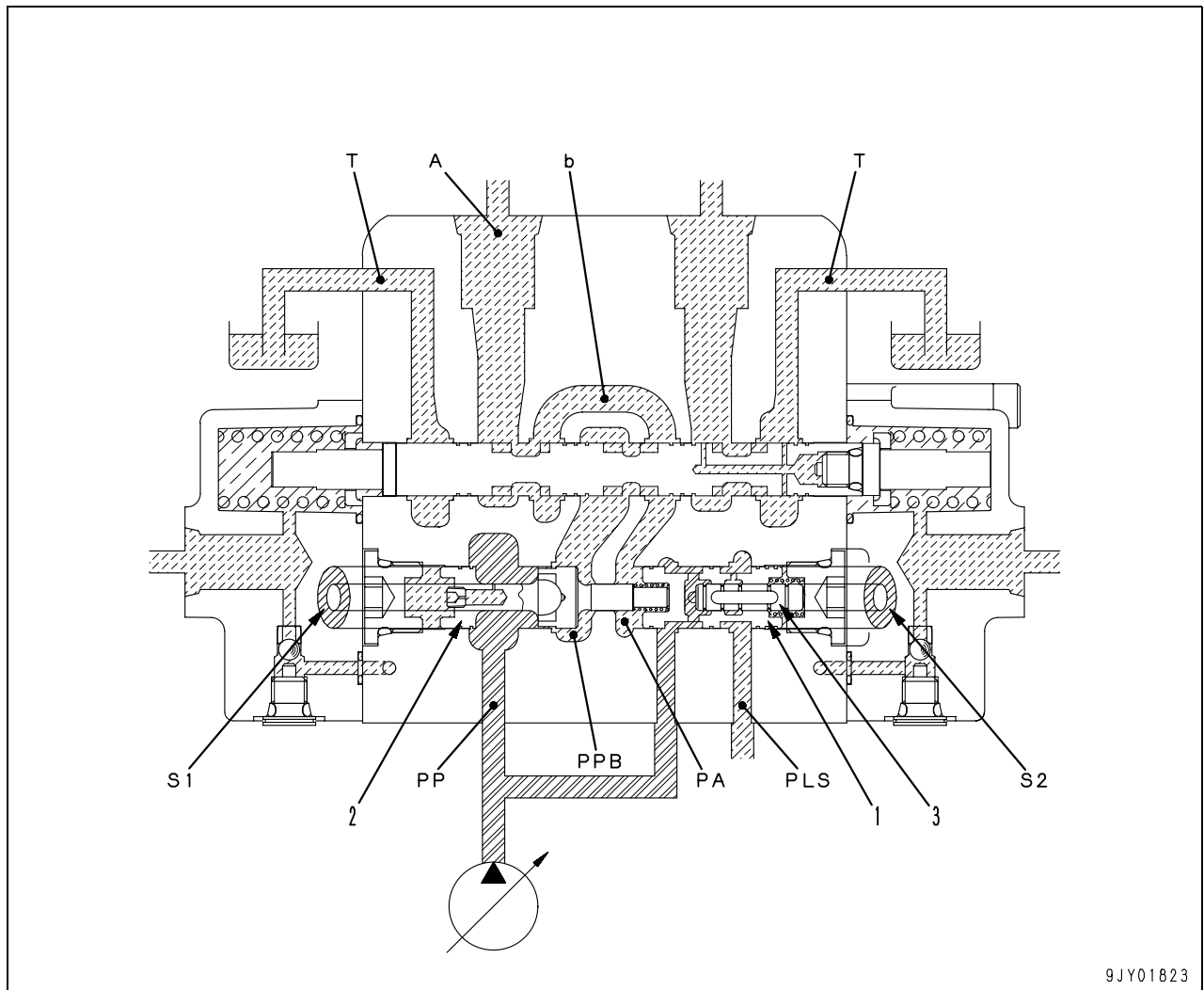
Function

- During compound operations, if the load pressure becomes lower than the other actuator and the oil flow tries to increase, compensation is received.
(When this happens, the other actuator being used for compound operation (right side) is at a higher load than the actuator on this side (left side).)

Operation

- If the load pressure of the other actuator (right side) becomes higher during compound operations, the oil flow in actuator circuit (A) on this side (left side) tries to increase.
- If this happens, the LS pressure (PLS) of the other actuator acts on spring chamber (PLS'), and reducing valve (1) and flow control valve (2) are pushed to the left.
- Flow control valve (2) throttles the area of opening between pump circuit (PP) and spool upstream (PPA), and pressure loss is generated between (PP) and (PPA).
- Flow control valve (2) and reducing valve (1) are balanced in position where the difference in pressure between (PLS) and (PA) acting on both ends of reducing valve (1) and the pressure loss between (PP) and (PPA) on both sides of flow control valve (2) are the same.
- In this way, the pressure difference between upstream pressure (PPA) and downstream pressure (PA) of both spools used during compound operations is the same, so the pump flow is divided in proportion to the area of opening of notch (a) of each spool.

Area ratio of pressure compensation valve



9JY01823

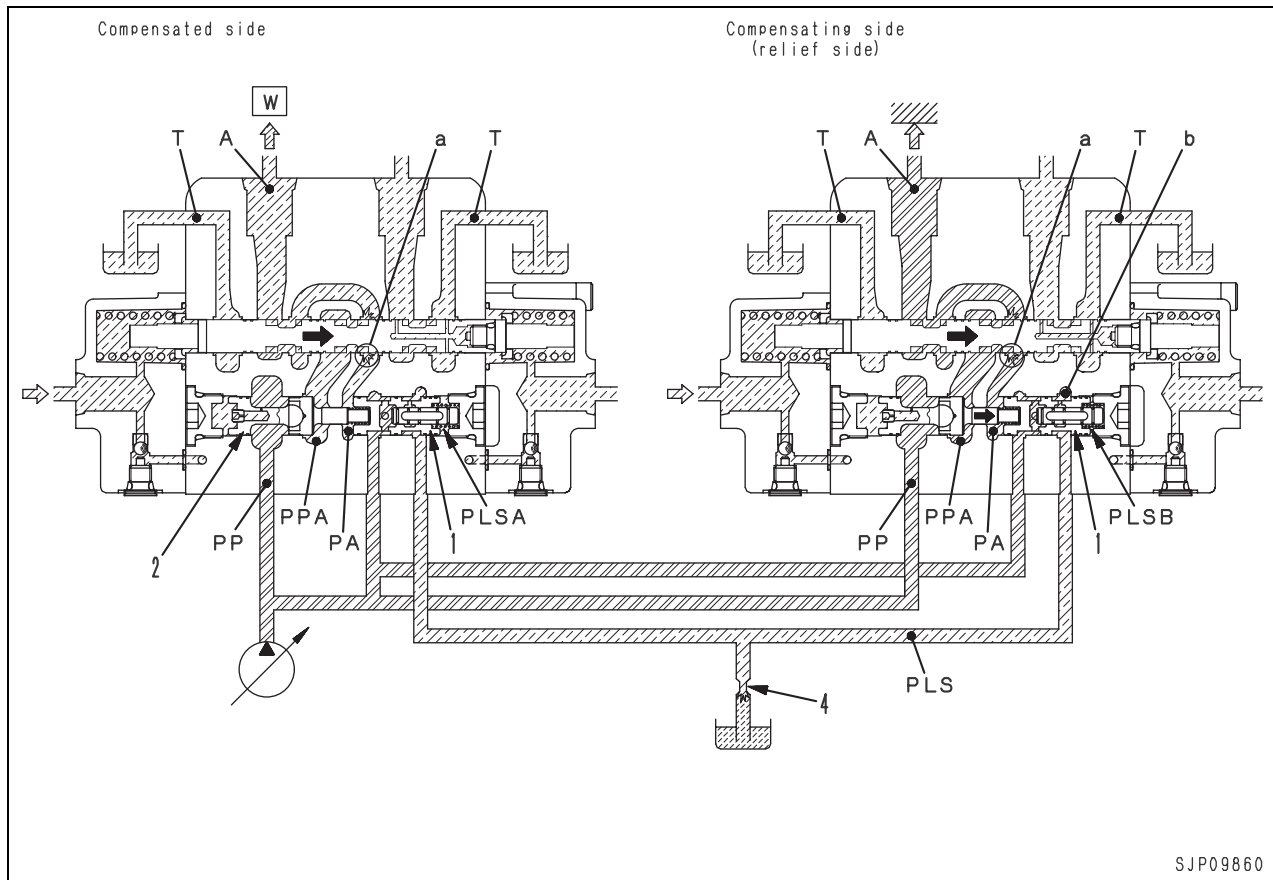
Function

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (S2) : (S1) between area (S2) of reducing valve (1) and area (S1) of flow control valve (2) to match the characteristics of each actuator.

{	S1: Area of flow control valve (2)
	– area of piston (3)
}	S2: Area of reducing valve (1)
	– area of piston (3)

Area ratio (S2) : (S1) and compensation characteristics

- When ratio is 1.00:**
[Pump pressure (PP) – spool notch upstream pressure (PPB)] \approx [LS circuit pressure (PLS) – actuator circuit pressure (PA) = (A)] and oil flow is divided in proportion to area of opening of spool.
- When ratio is more than 1.00:**
(PP) – (PPB) > (PLS) – (PA) = (A) and oil flow is divided in a proportion less than area of opening of spool.
- When ratio is less than 1.00:**
(PP) – (PPB) < (PLS) – (PA) = (A) and oil flow is divided in a proportion more than area of opening of spool.

LS receiving throttle of pressure compensation valve**Function**

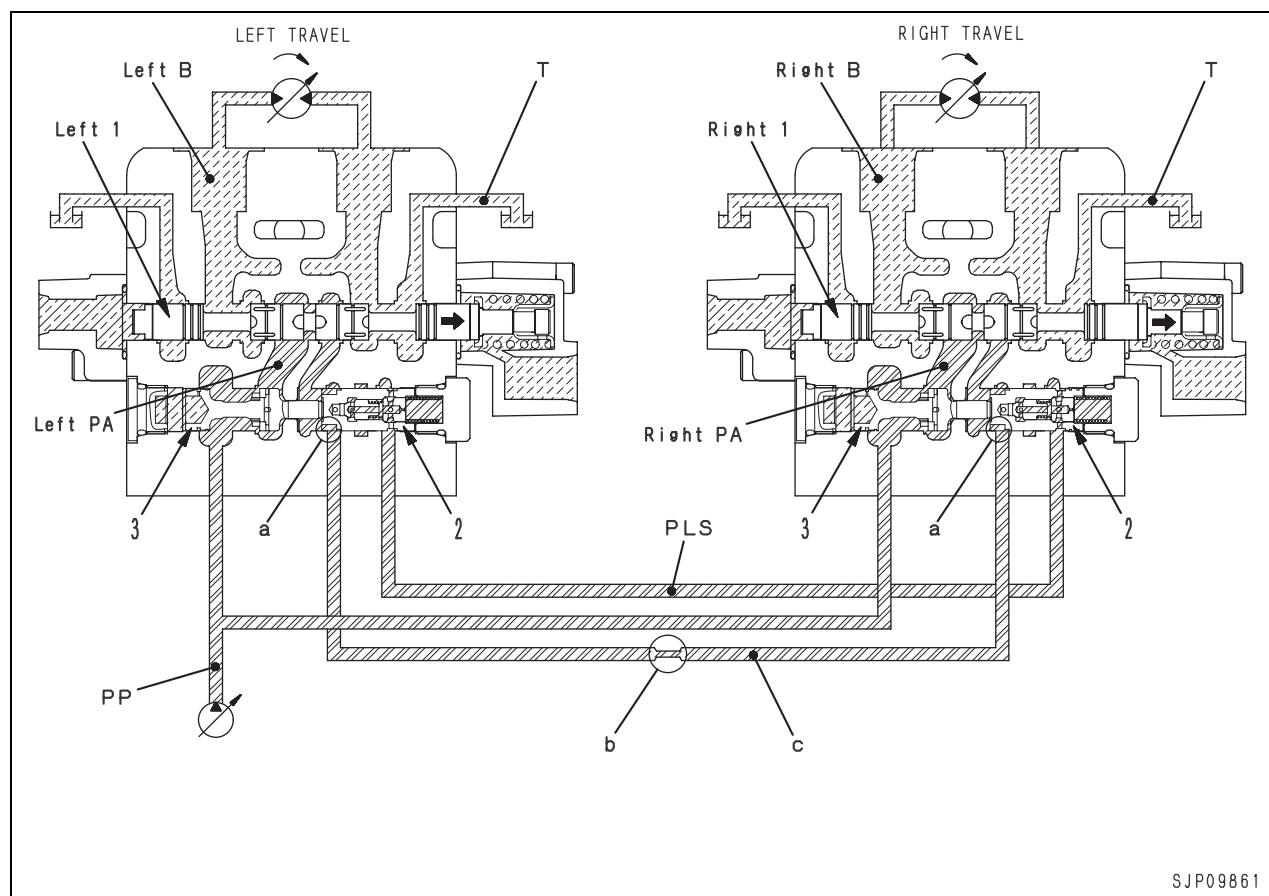
- If the other actuator is relieved during compound operations, LS introduction throttle (b) of reducing valve (1) divides the flow and sends more oil to the side receiving compensation.

Operation

- If the other actuator (right side) is relieved during compound operations, each circuit pressure (PPA), (PA) of the other actuator becomes the same as the pump circuit pressure [(PP) = relief pressure].
- In this case, spring chamber (PLSA) of the other actuator becomes the same as pump circuit pressure (PP) because of the balance of reducing valve (1).
- (PLSB) passes through LS introduction throttle (b) of reducing valve (1) and becomes (PLS). (PLS) is connected to the tank circuit (T) from LS bypass plug (4), so pressure loss is generated at LS introduction throttle (b) [the condition becomes (PLS) < (PLSB)].
- As a result, even if the other actuator is relieved, a pressure difference is created between (PP) and (PLS), so more oil flows to actuator circuit (A) on this side (left side).

L.H., R.H. Travel junction circuit PC27MR, 30MR-3

1. When traveling in a straight line



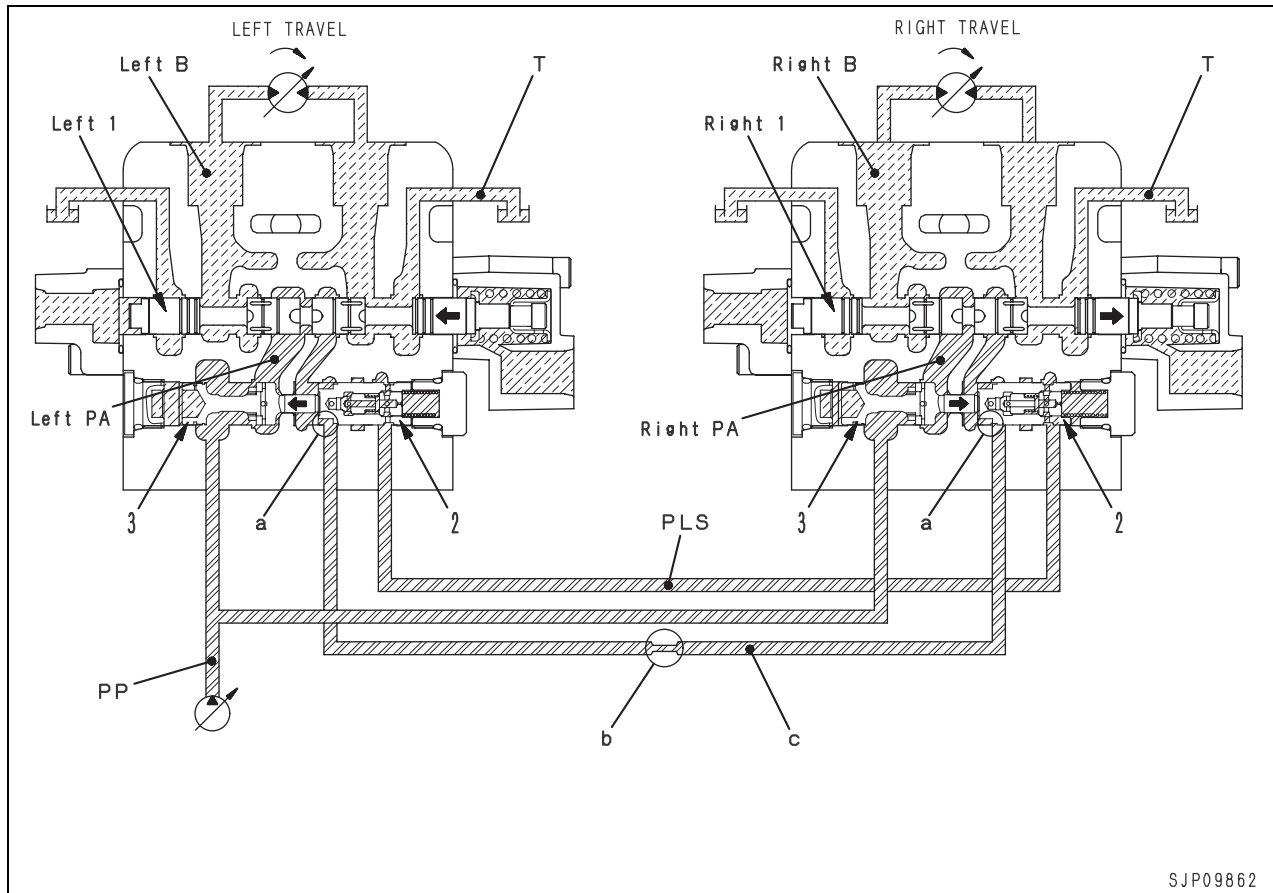
Function

- To compensate for any difference in the oil flow in the left and right travel circuits when traveling in a straight line, the junction circuit opens when the left and right travel spools are operated.
- In this way, the flow of oil to the left and right travel motors is almost the same when traveling in a straight line, so there is no travel deviation.
- When steering the machine, the difference in the load pressure returns the reducing valve of the travel valve on the inside of the turn and the opening of the notch in the travel junction valve spool becomes smaller, so the machine can be steered.

Operation

- When left and right travel spools (1) are operated, the pump discharge flows from pump circuit (PP) and circuits (PA) to actuator circuits (B).
- When traveling in a straight line, to make actuator circuits (PA) equal, left and right reducing valves (2) are pushed to the right by the same amount, and notch (a) and the travel junction circuit are opened.
- In this way, the left and right travel actuator circuits are interconnected by the travel junction circuit, so if any difference occurs in the flow of oil to the left and right travel motors, the compensation is carried out to prevent any deviation in travel.

2. Steering when traveling



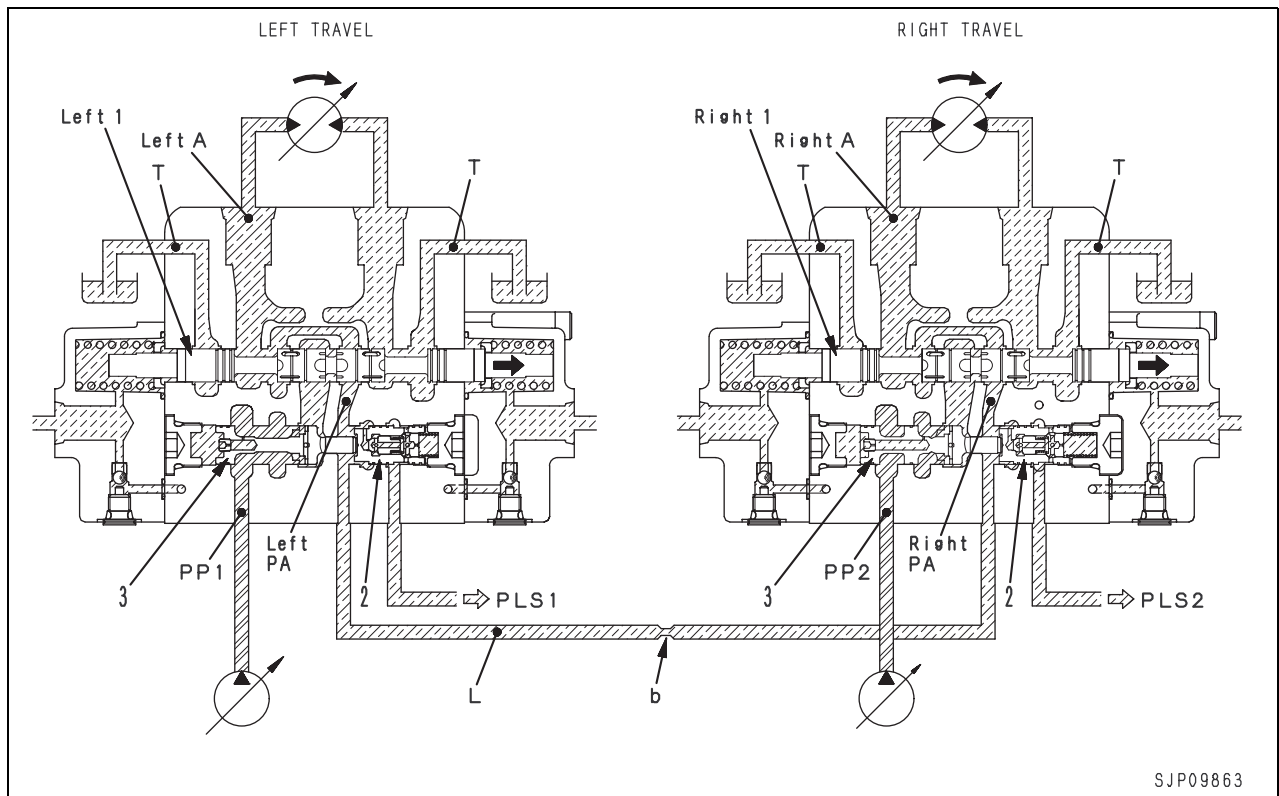
SJP09862

Operation

- When traveling in a straight line, if left travel spool (Left 1) is returned to the neutral position and the steering is operated, a difference (Right B) > (Left B) is generated in the load pressure of left and right travel actuator circuits (PA), and LS pressure (PLS) becomes the same pressure as (Right B).
- As a result, flow control valve (3) on the left travel side is pushed to the left by LS circuit (PLS). Because of this, the opening of the left notch (a) is made smaller, so it becomes possible to operate the steering when traveling.
- Damper (b) is provided in the circuit to damper any excessive characteristics in the opening or closing of the travel junction circuit if the spool is operated suddenly.

PC35MR-3

1. During straight travel

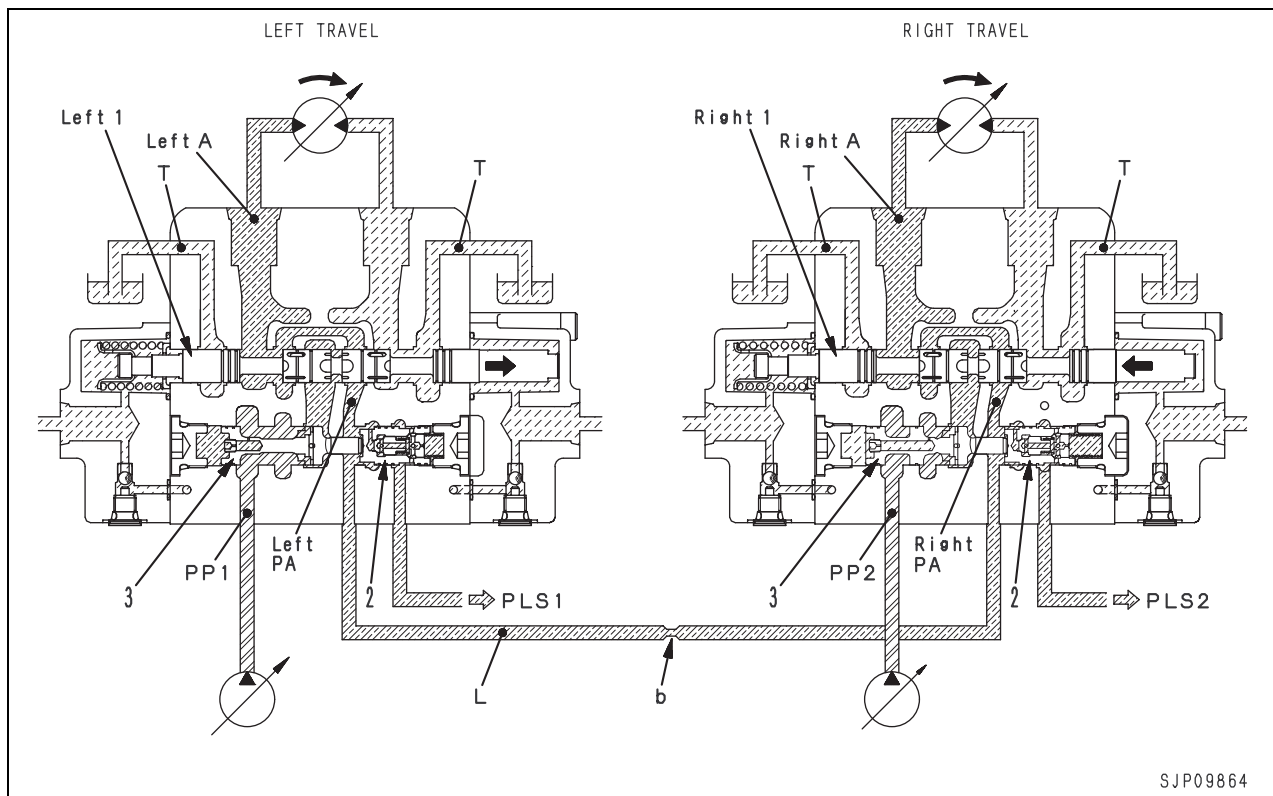


Function

- An interconnection circuit is installed to correct the flow error in both travel circuits during straight travel.
- With this circuit, the flow rates in both travel motors become almost the same during straight travel to reduce travel deviation.
- Dampers (b) are installed to ease the transient characteristics of sudden opening and closing of the interconnection circuit when the machine is steered and the spools are operated sharply.

Operation

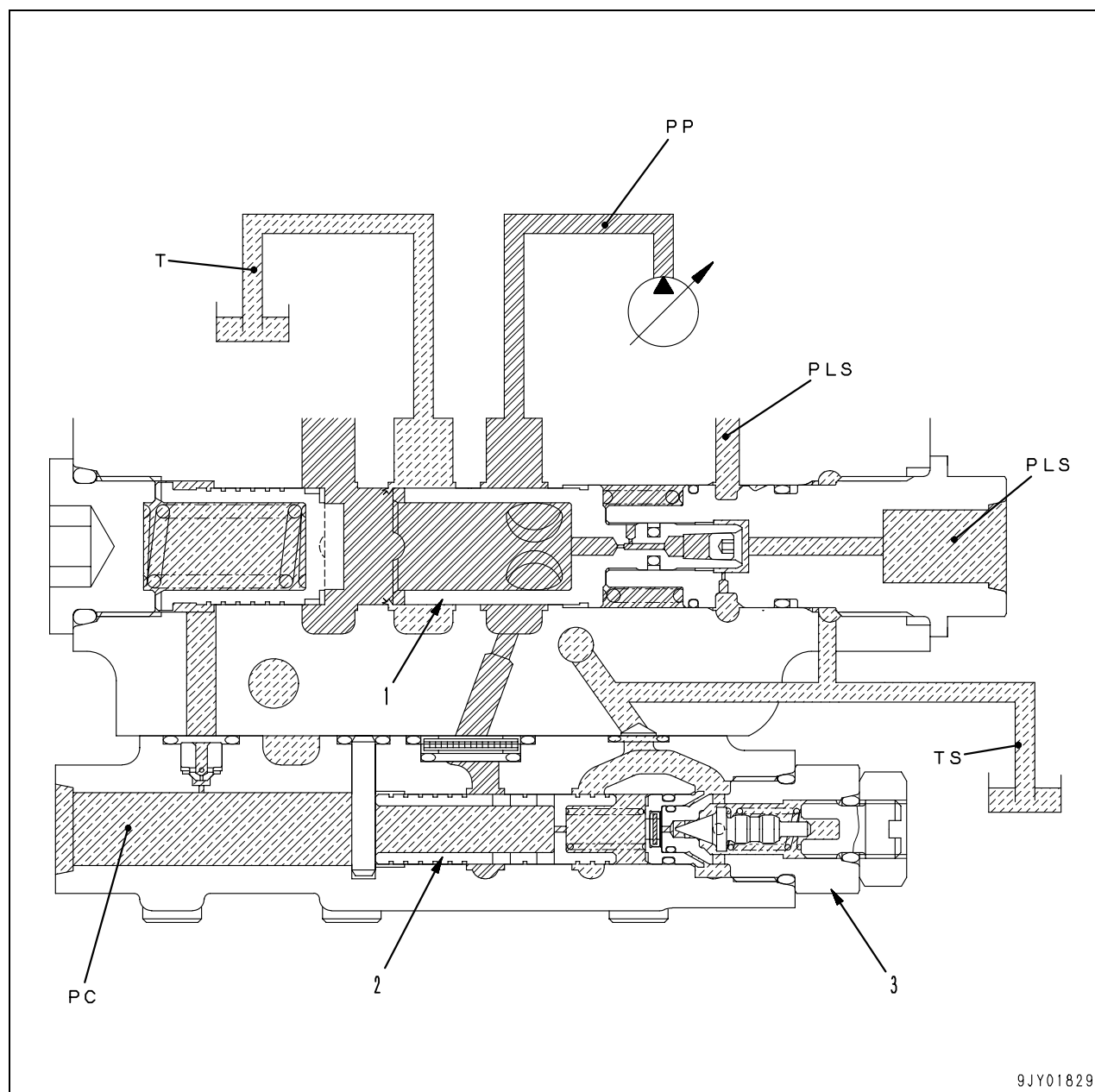
- Bridge circuits (PA) of both travel circuits are connected to each other by interconnection circuit (L). Accordingly, if there is difference between the oil flow rates in both travel motors, it is corrected to reduce the travel deviation.

2. Steering when traveling**Operation**

- When the right travel spool (Right 1) is returned to the neutral position to steer the machine in the straight travel state, the load pressures in both travel actuator circuits (PA) become different (Left A) > (Right A).
- Since the main pump is separated at this time, oil flows in both travel motors according to the opening area of the spool.

Self pressure reducing valve PC27MR, 30MR-3

1. When the control valve is held

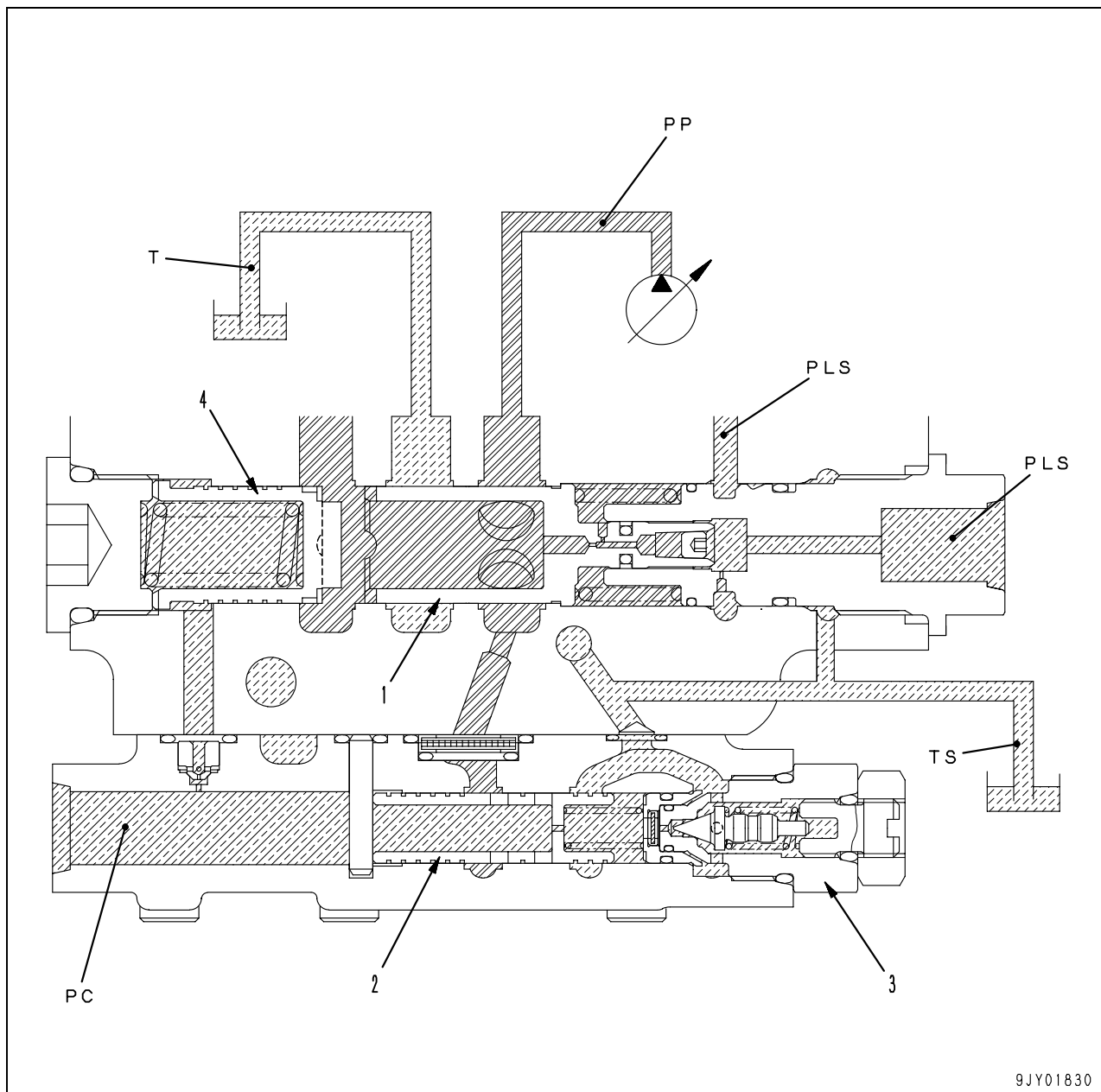


Function

- This valve reduces pump discharge pressure (PP) and supplies the pilot main pressure of 2.90 MPa {30.0 kg/cm²} to the PPC valve.
- When the actuator circuit pressure is low, the self pressure sequence valve is closed to raise pump discharge pressure (PP) to secure the pilot main pressure.

Operation

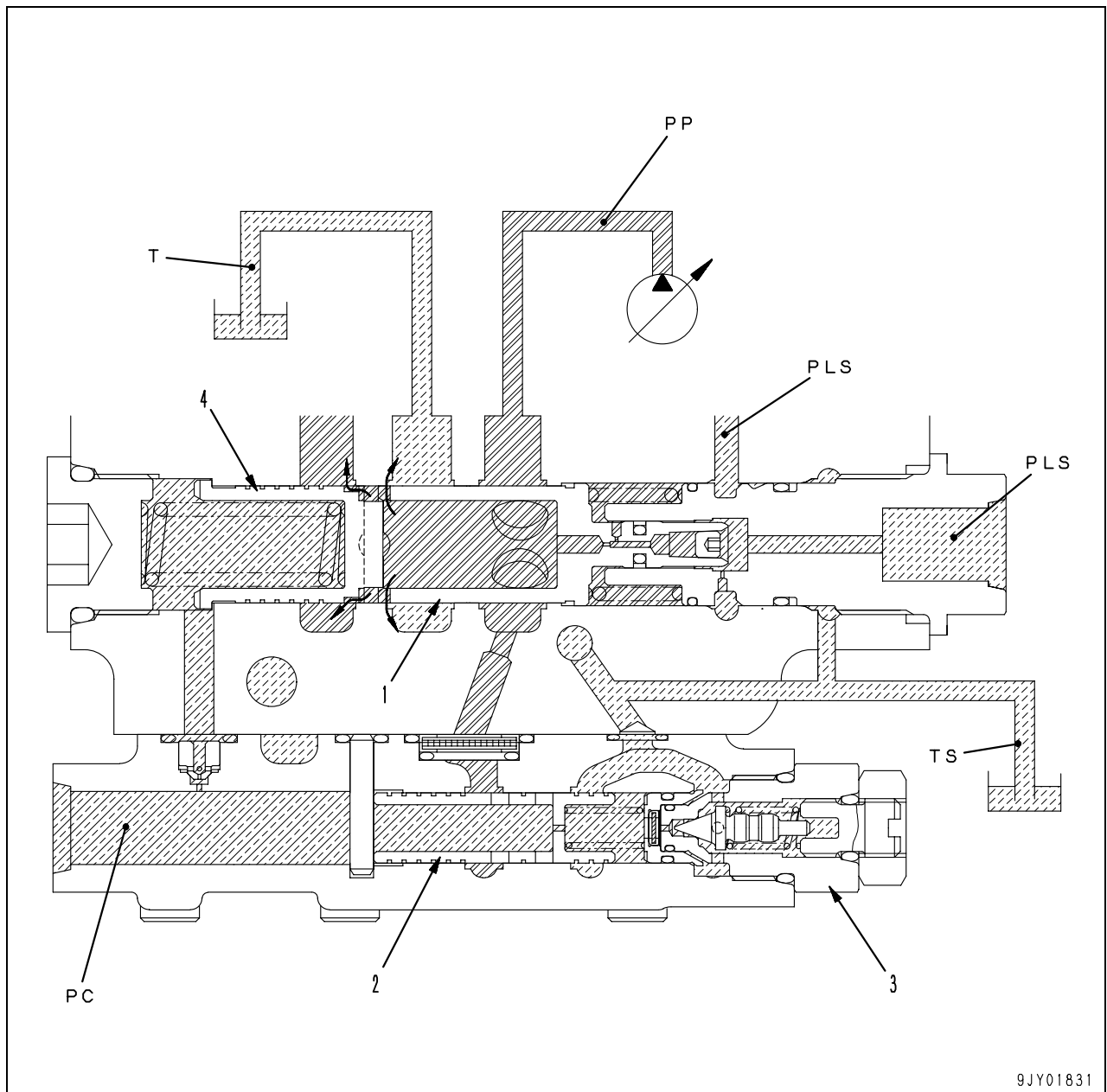
- Unload spool (1) moves and pump discharge pressure (PP) is set to 2.90 MPa {30.0 kg/cm²}. (See the explanation of the unload valve.)
- Pump discharge pressure (PP) is reduced to 2.90 MPa {30.0 kg/cm²} by self pressure reducing spool (2) and self pressure reducing pilot relief valve (3), and the main pressure oil is supplied through the port (PC) to the PPC valve.

2. When the control valve is operated

9JY01830

Operation

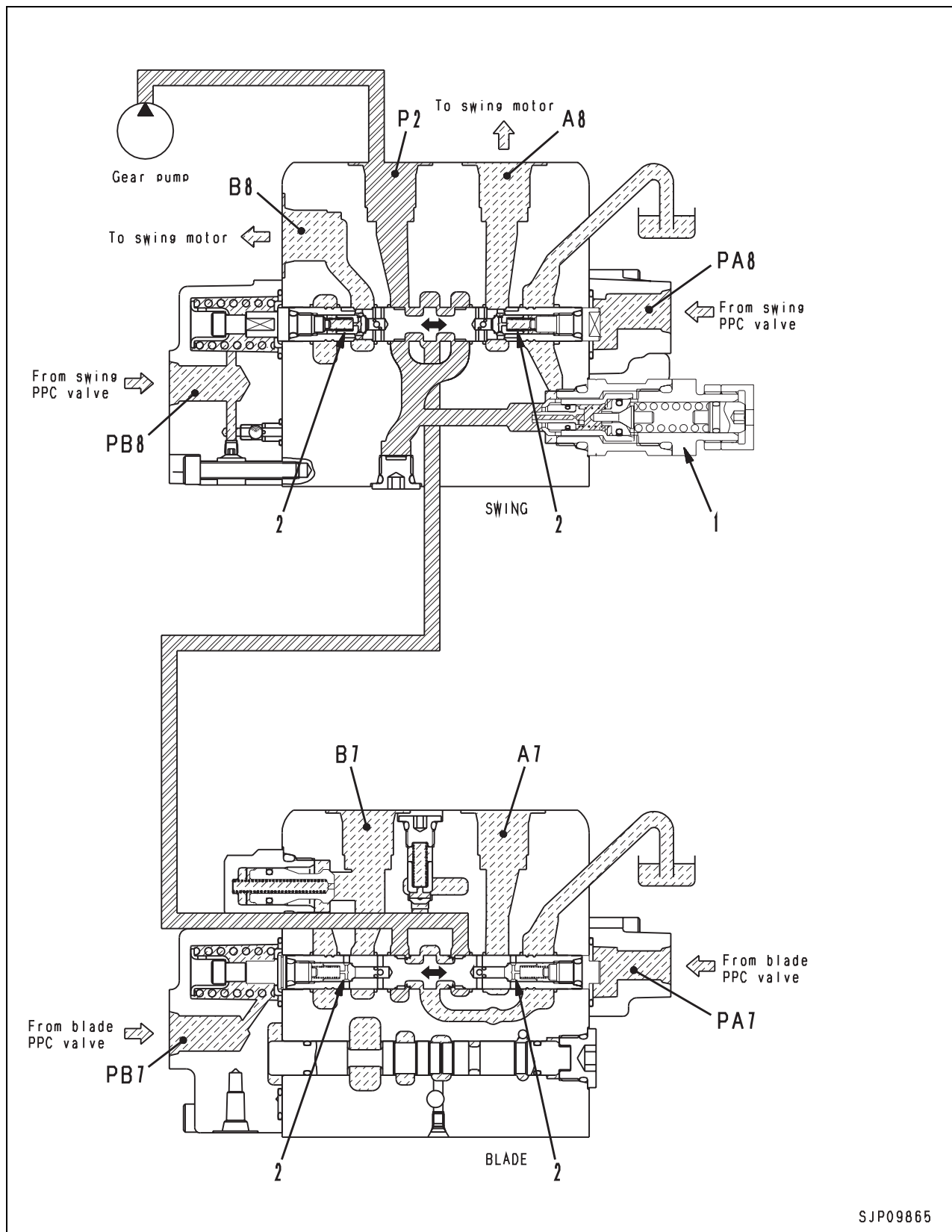
- Unload spool (1) moves to the left and pump discharge pressure (PP) becomes higher than the LS pressure by the LS differential pressure. (See the explanation of unload valve.)
- When pump discharge pressure (PP) is higher than 2.90 MPa {30.0 kg/cm²}, it is reduced to 2.90 MPa {30.0 kg/cm²} by self pressure reducing spool (2) and self pressure reducing pilot relief valve (3), and the pressure oil is supplied through the port (PC) to the PPC valve.
- At this time, self pressure sequence valve (4) is kept open.



9JY01831

Operation

- When pump discharge pressure (PP) is below 2.90 MPa {30.0 kg/cm²}, self pressure sequence valve (4) moves to the right to reduce the opening area between (PP) and actuator circuit (5).
- As a result, differential pressure is made between (PP) and actuator circuit (5) and (PP) is raised to above 2.90 MPa {30.0 kg/cm²}, then it is reduced to 2.90 MPa {30.0 kg/cm²} by self pressure reducing spool (2) and self pressure reducing pilot relief valve (3), and the pressure oil is supplied through the port (PC) to the PPC valve.

Swing and blade valve

SJP09865

Structure

- The swing and blade sections are the open center valves of the gear pump. They are arranged tandem, with the swing section ahead of the blade section.

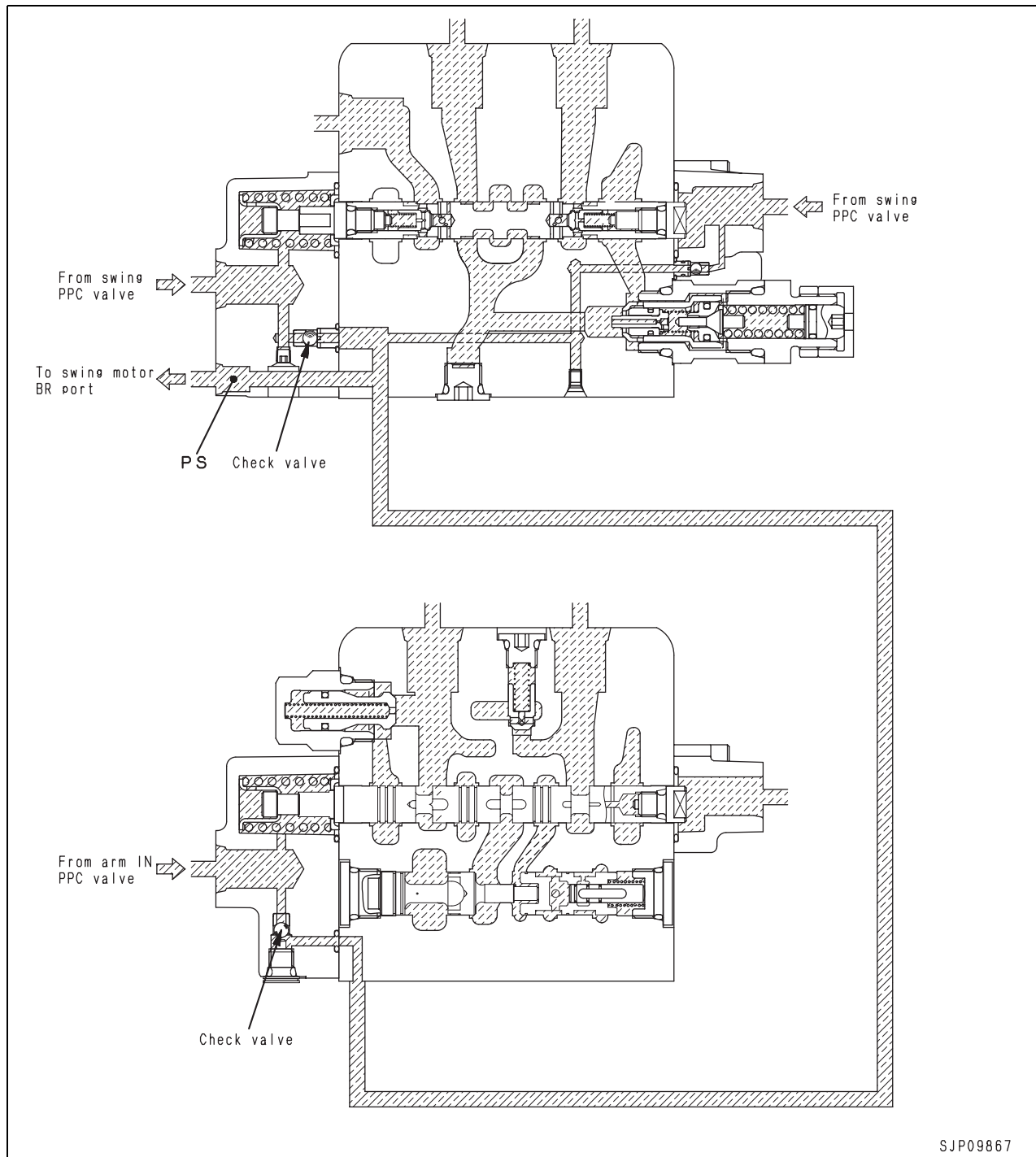
Operation

Swing section

- If pressure is applied from the PPC valve to the port (PA8), the spool moves to the left and oil flows in the port (A8).
- If pressure is applied from the PPC valve to the port (PB8), the spool moves to the right and oil flows in the port (B8).
- Load check valve (2) is installed in each spool, corresponding to ports (A) and (B) of each valve.
- Relief valve (1) for the gear pump is installed to the swing section.

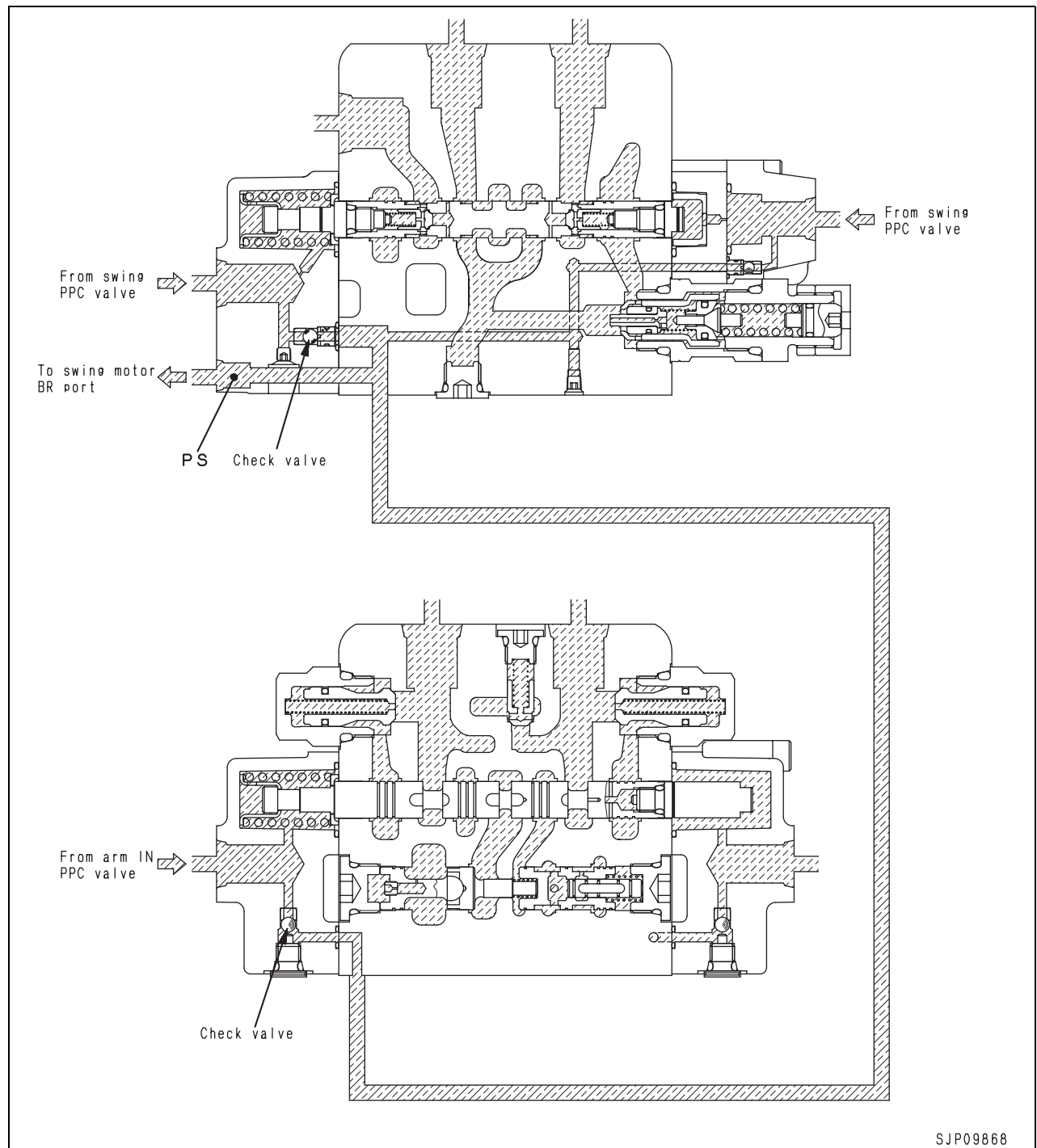
Blade section

- If pressure is applied from the PPC valve to the port (PA7), the spool moves to the left and oil flows in the port (A7).
- If pressure is applied from the PPC valve to the port (PB7), the spool moves to the right and oil flows in the port (B7).
- Load check valve (2) is installed in each spool, corresponding to ports (A) and (B) of each valve.

Swing holding brake cancel system
PC27MR, 30MR-3**Function**

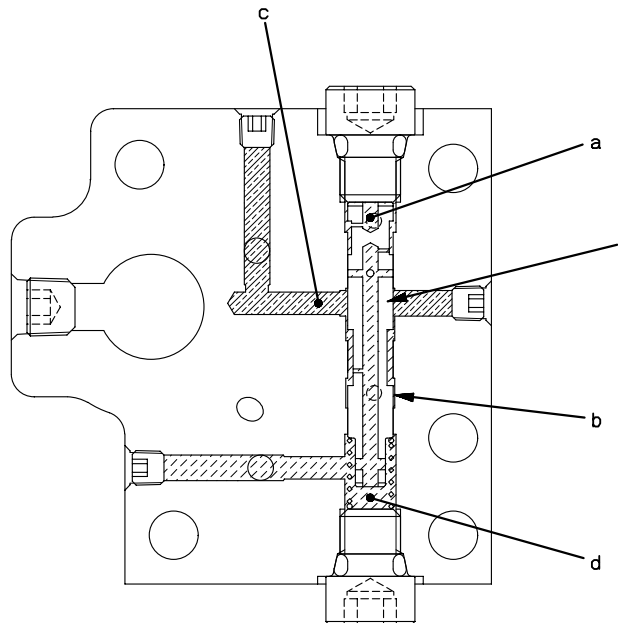
- This system resets the swing holding brake by using both swing PPC pressures and arm IN PPC pressure as signals.

PC35MR-3



Operation

- The left and right swing PPC pressure and the arm IN PPC pressure each pass through check valve inside spring case, are output to port (BR) from port (PS), and the swing holding brake is canceled. (The highest pressure is output to port (BR).)
- The arm and swing are connected by the pilot circuit inside the control valve.

Logic valve
PC35MR-3

9JS08328

Function

- This valve changes the pilot pressure to change the merge-divider valve.

Operation**1. When divided**

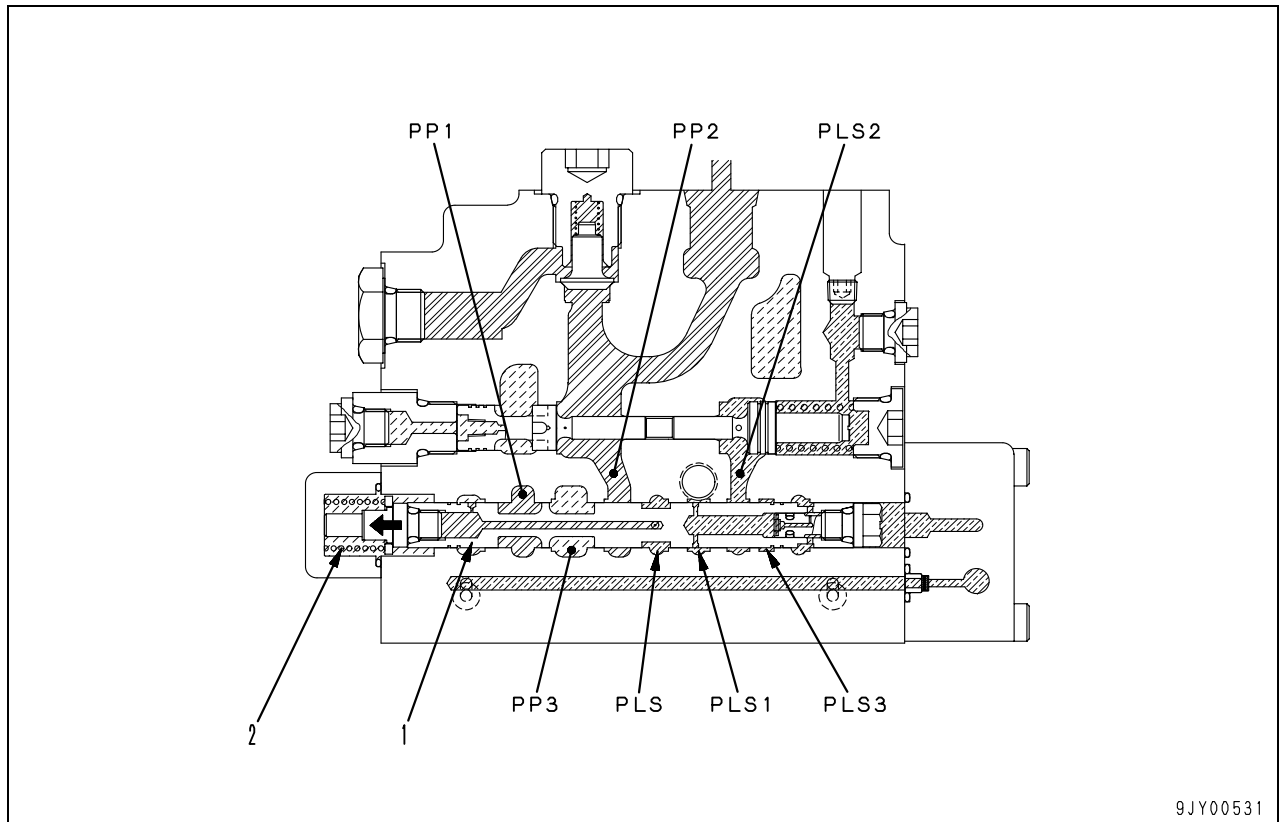
- If only the travel PPC pressure is applied to port (b), it is applied to output port (c) of the pump merge-divider valve as it is. This pressure sets the pump merge-divider valve in the division mode.

2. When merged

- If the work equipment PPC pressure (excluding the swing pressure) is applied to port (a), the pressure in output port (c) of the pump merge-divider valve is connected through spool (1) to spring chamber (d) and used as seal drain pressure.
- Accordingly, the pump merge-divider valve is not changed but kept in the merging mode. Even if the travel PPC pressure is applied under this condition, spool (1) is kept pressed and the valve is kept in the merging mode.

Merge-divider valve PC35MR-3

1. When machine travels singly



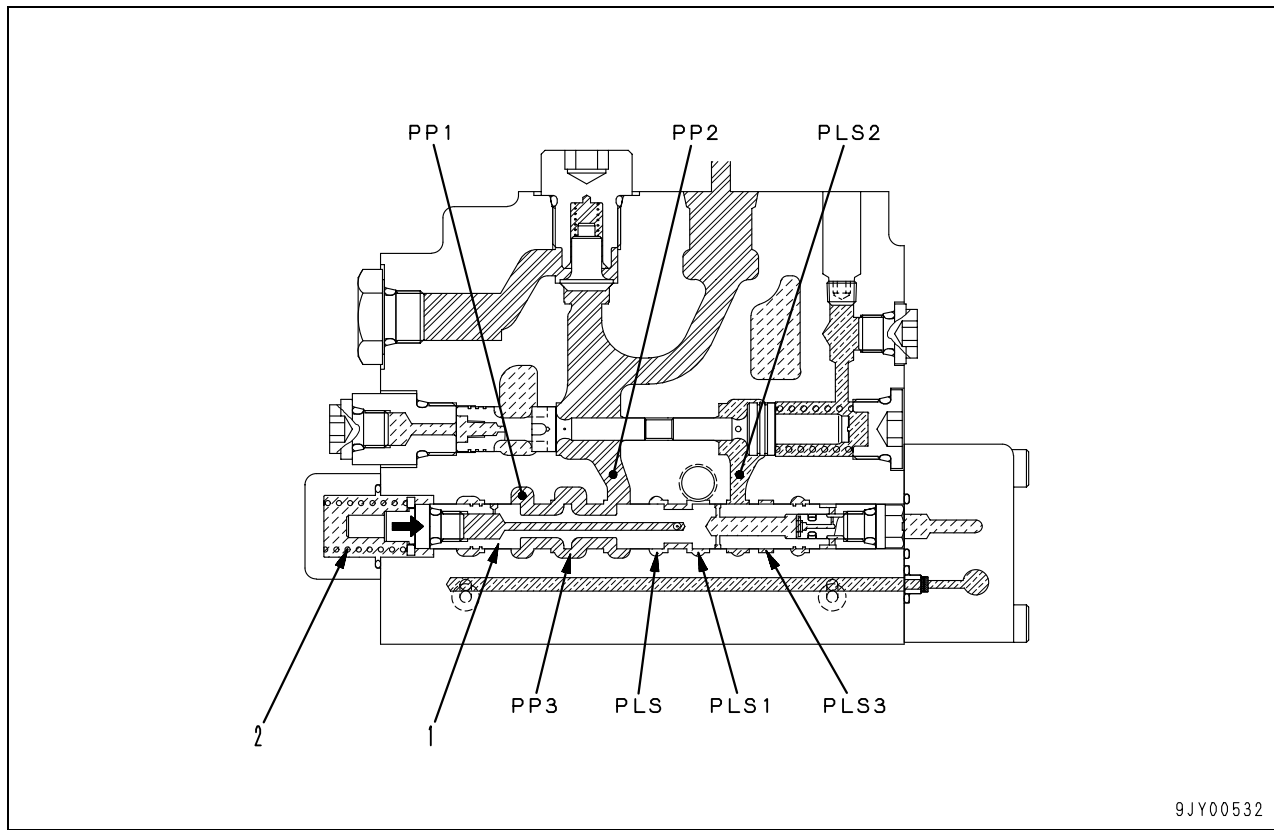
Function

- When the machine travels singly, the merge-divider valve spool separates pump pressures (PP1) and (PP2).

Operation

- When the machine travels singly, the travel port pressure is applied through the logic valve spool to the right side of merge-divider valve spool (1). If this pressure exceeds the force of spring (2), merge-divider valve spool (1) is pushed to the right and left to separate pump pressures (PP1), (PP2) and (PP3).
- At this time, LS pressures (PLS1), (PLS2) and (PLS3) are also separated from each other. The pump pressure is output to output pressure (PLS) applied to the pump LS valve.

2. When "work equipment is operated" and when "machine travels and work equipment is operated simultaneously"



9JY00532

Function

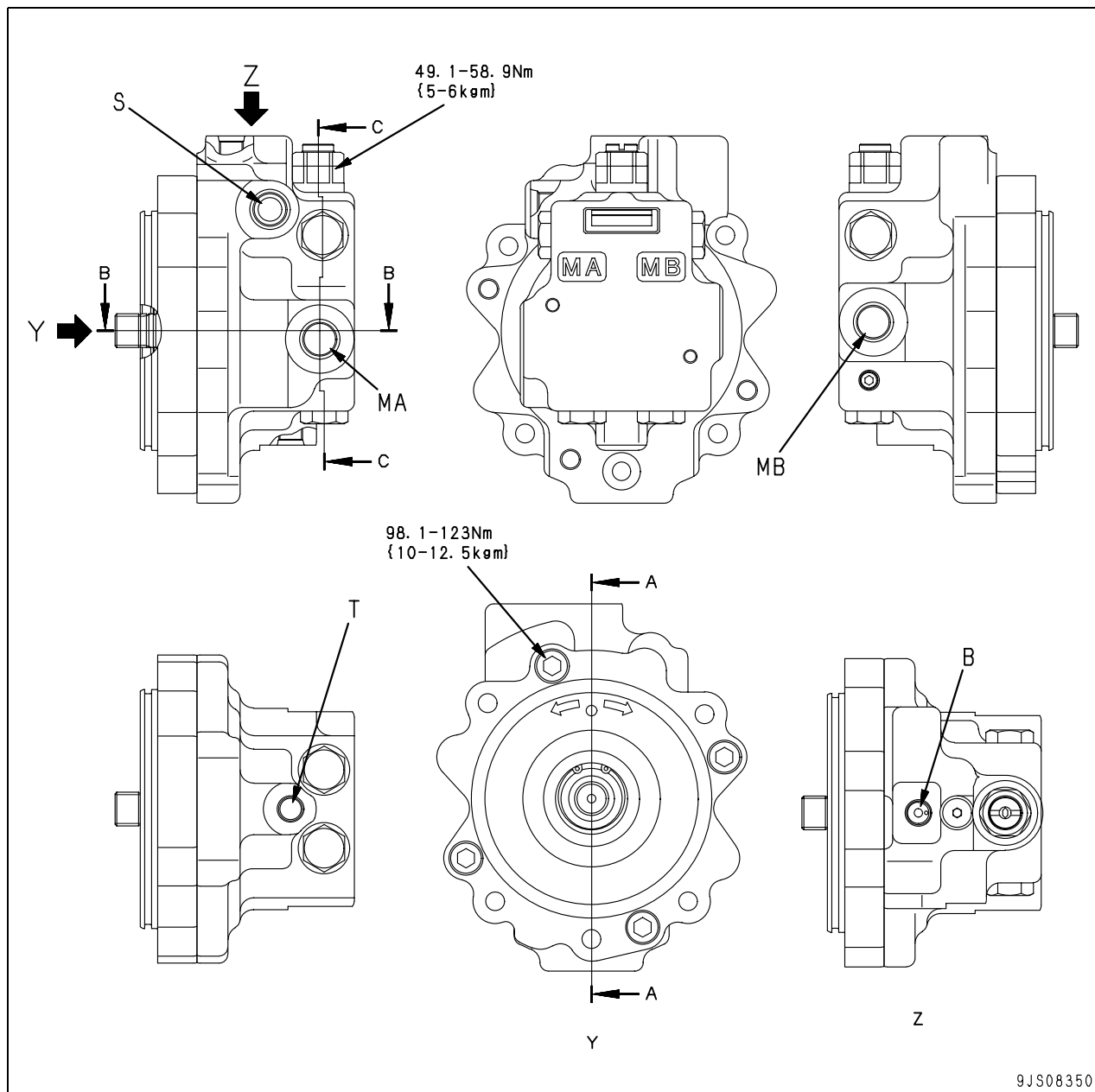
- When the work equipment is operated and when the machine travels and the work equipment is operated simultaneously, the merge-divider valve spool merges pump (discharge) pressures (PP1) and (PP2).

Operation

- When the work equipment is operated, the output of the logic valve spool becomes seal drain and the oil for changing the pump merge-divider valve is drained into the tank.
- Accordingly, merge-divider valve spool (1) is pressed to the right by the force of spring (2) and pump pressures (PP1), (PP2) and (PP3) are merged. At this time, LS pressures (PLS1), (PLS2) and (PLS3) are merged, too.
- When the machine travels and the work equipment is operated simultaneously, the travel port pressure is not applied to the pump merge-divider valve, since the logic valve spool is changed. Since the oil for changing the pump merge-divider valve is drained into the tank, the oils are merged.
- When the control lever is in neutral, the spring force of the pump merge-divider valve spool is larger because of the valve changing force made by the travel PPC pressure. Accordingly, the oils are merged.

Swing motor

Type: LMF16



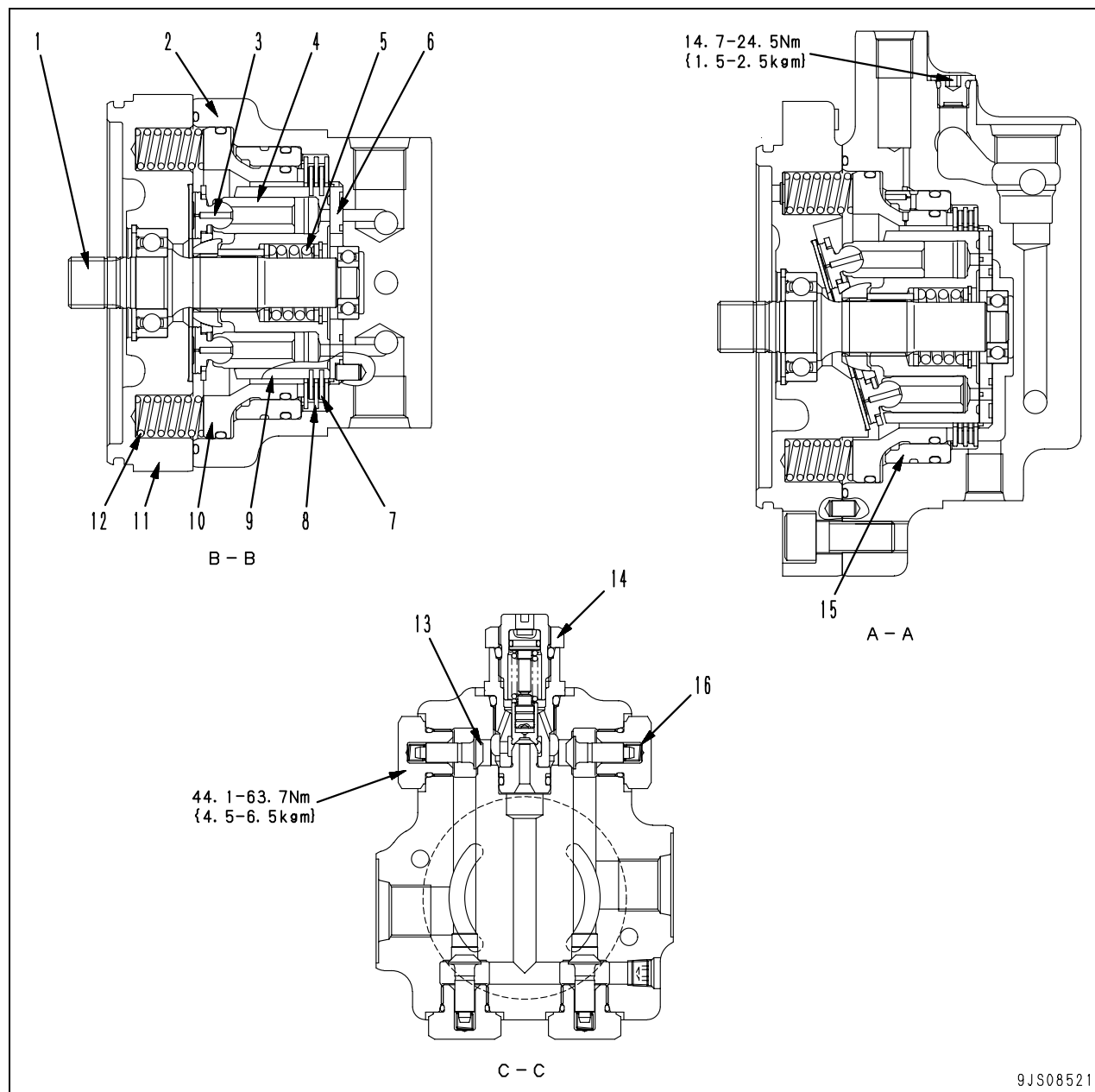
B: From control valve
S: From tank

T : To tank
MA: From control valve

MB: From control valve

Specifications

Type	: LMF16
Theoretical discharge	: 16.1 cm ³ /rev
Rated speed	: 1,600 rpm
Rated delivery	: 19 ℓ/min
Suction valve cracking pressure:	0.04 MPa {0.45 kg/cm ² }
Safety valve set pressure	: 17.2 MPa {175 kg/cm ² }



- | | | |
|------------------|------------------|------------------|
| 1. Output shaft | 7. Disc | 13. Check valve |
| 2. Housing | 8. Plate | 14. Safety valve |
| 3. Shoe | 9. Cylinder | 15. Brake ring |
| 4. Piston | 10. Brake piston | |
| 5. Center spring | 11. Swash plate | |
| 6. Valve plate | 12. Brake spring | |

Unit: mm

No.	Check item	Criteria					Remedy
16	Check valve spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		13.0 × 6.5	7	3.43 N {0.35 kg}	—	2.75 N {0.28 kg}	

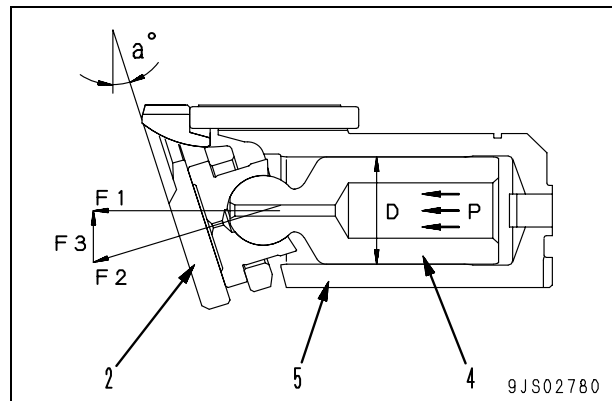
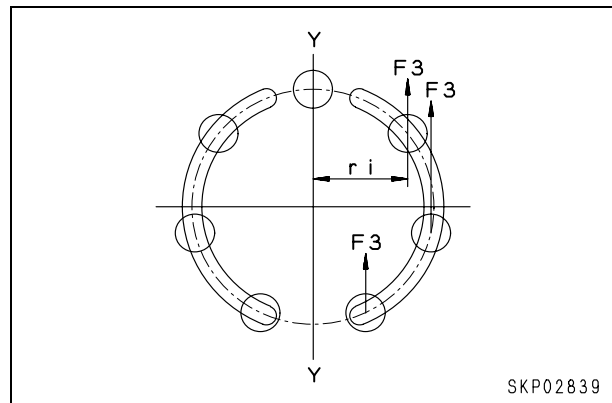
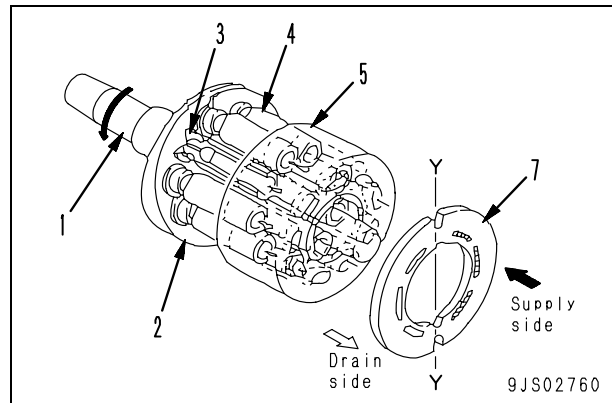
Hydraulic motor portion

Function

- This hydraulic motor is a swash plate type axial piston motor, which converts the hydraulic force sent from the hydraulic pump to a rotating movement.

Principle of operation

- The oil sent from the hydraulic pump goes from valve plate (7) and enters cylinder block (5). The structure of the motor takes in the oil at one side only of the (Y – Y) line joining the top and bottom dead centers of the stroke of piston (4).
- The pressure oil entering one side of cylinder block (5) generates force F_1 [F_1 (N {kg}) = P (MPa {kg/cm²}) $\times \pi/4 D^2$ (cm²)] pushing each piston (4) (3 or 4 pistons).
- This force acts on thrust plate (2), but thrust plate (2) is secured at a certain angle (a) to output shaft (1), so the force is divided into force (F_2) and (F_3).
- Of the divided forces, the radial force (F_3) generates the torque ($T = F_3 \times r_i$) for line (Y – Y) joining the top and bottom dead centers.
- The combined force of this torque $\{T = \Sigma (F_3 \times r_i)\}$ goes as a rotating force through the piston (4) to rotate cylinder block (5).
- Cylinder block (5) is joined to the output shaft by a spline, so the output shaft rotates and transmits the torque.

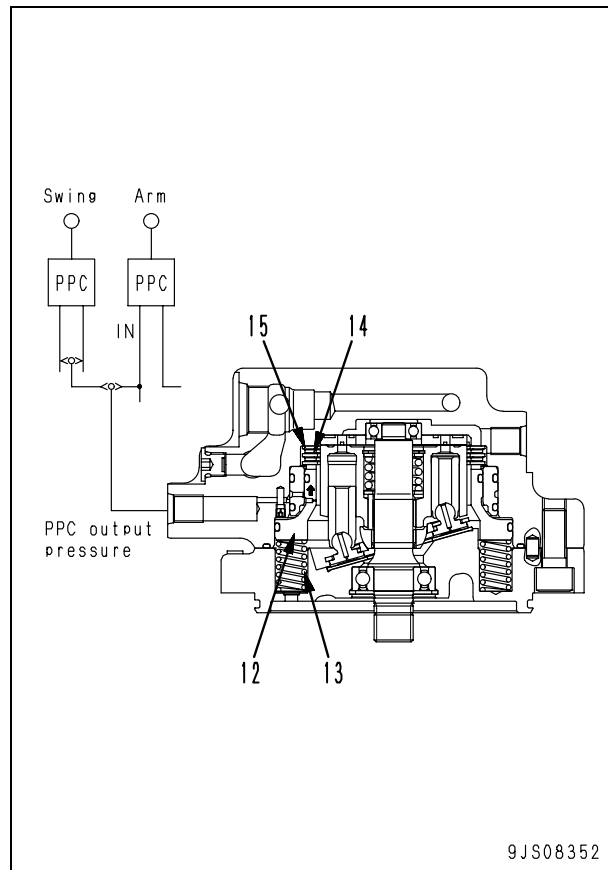


Swing brake

Operation

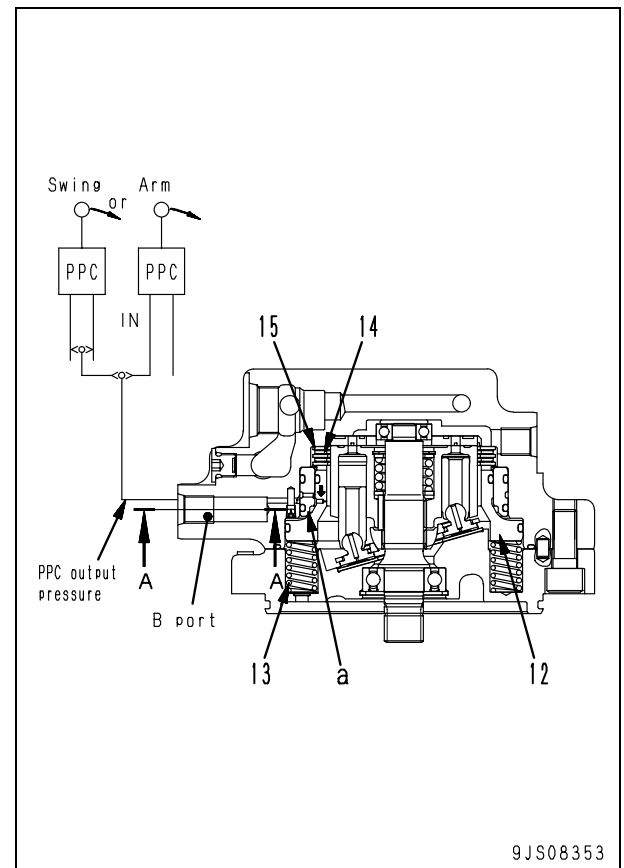
1. When swing and arm control levers are in neutral

- Since the PPC output pressure is 0 MPa {0 kg/cm²}, brake piston (12) is pushed up by brake spring (13). As a result, disc (14) and plate (15) are pressed and the brake works.



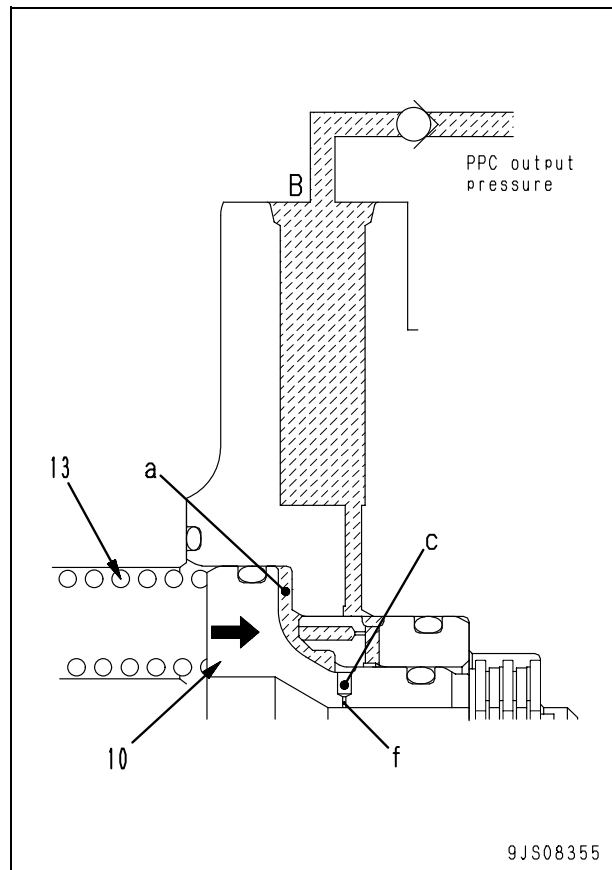
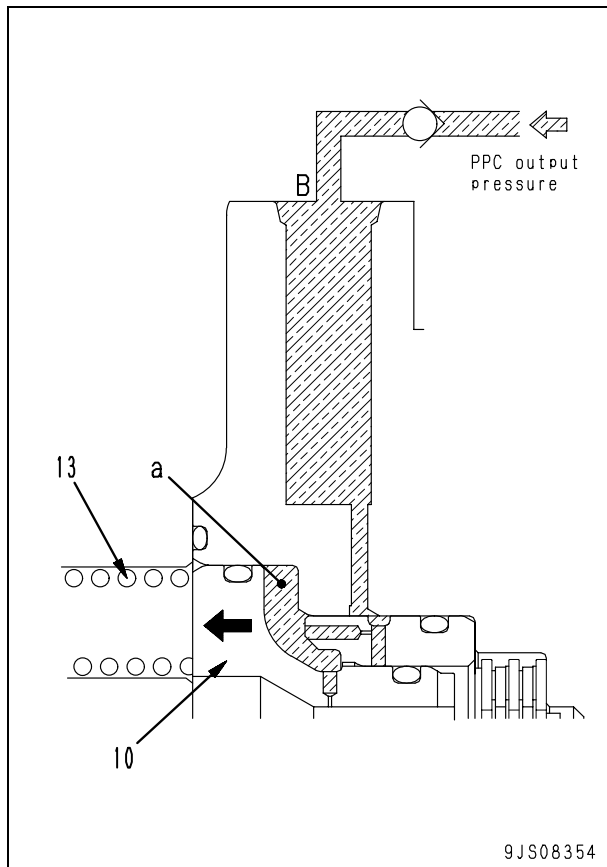
2. When swing and arm control levers are operated

- The PPC output pressure flows through port (B) into brake chamber (a). The oil in chamber (a) presses down brake spring (13). As a result, brake piston (12) moves down and disc (14) and plate (15) are separated, thus the brake is released.



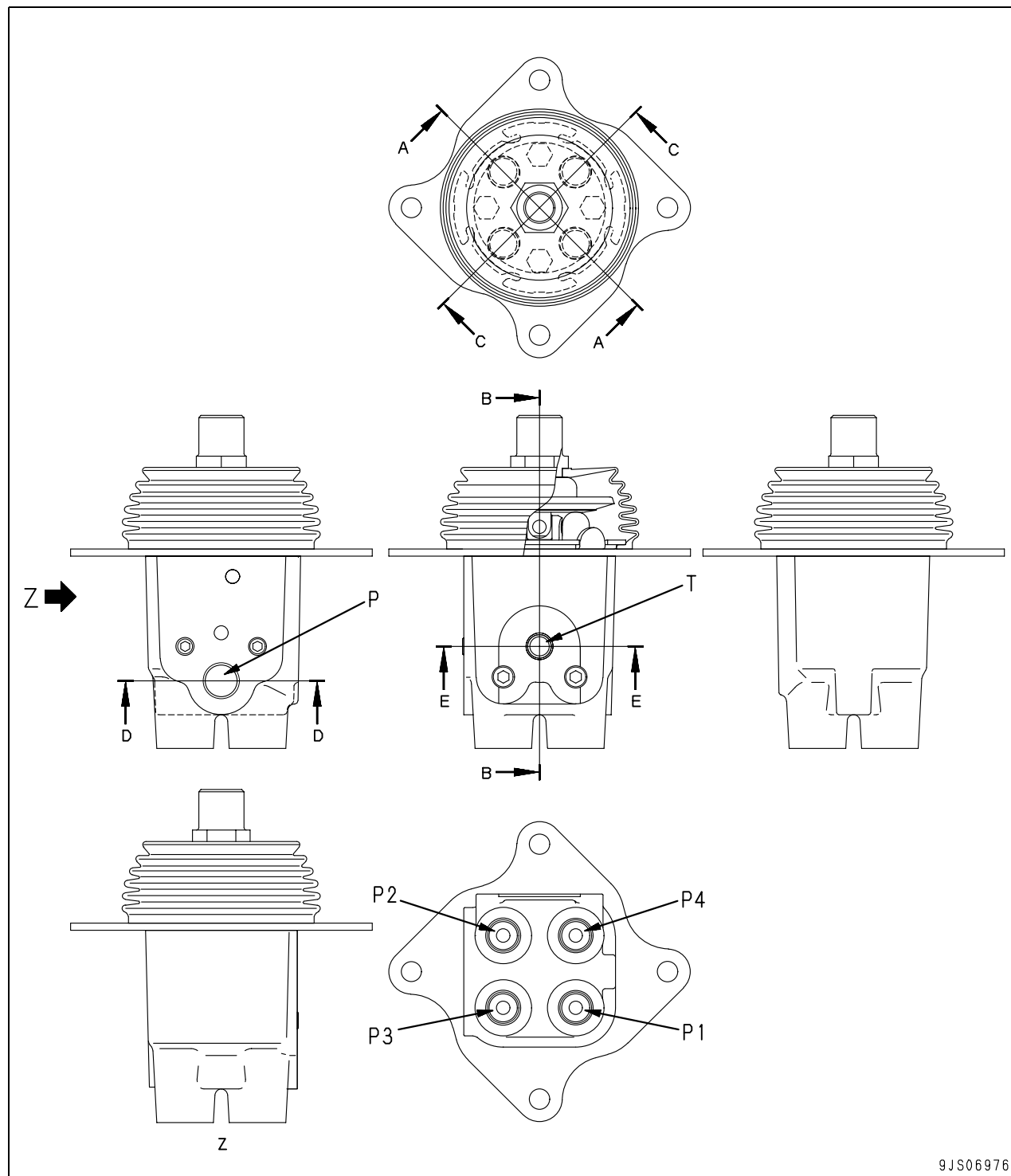
3. Actuation of hydraulic timer

- The hydraulic timer acts to delay the start of the swing brake effect in order to ensure smooth deceleration and to prevent damage to the parts of the motor when the swing motor stops and the swing brake is applied suddenly.
- When the PPC lever is actuated, PPC output pressure is applied to chamber (a) and the swing brake is released. In this condition, if the PPC lever is set in neutral, the supply of pressure oil to port (B) stops and the pressure in chamber (a) drops. As a result, the oil in chamber (a) is pushed out by brake spring (13).
- There is a check valve in the control valve on the port (B) side, so the oil does not flow through but flows out to passage (c). However, the passage of the oil is throttled by orifice (f) ($\phi 0.5$) in the brake piston (10), so the oil in chamber (a) flows out only slowly, and this delays the actuation of the swing brake by the determined amount.



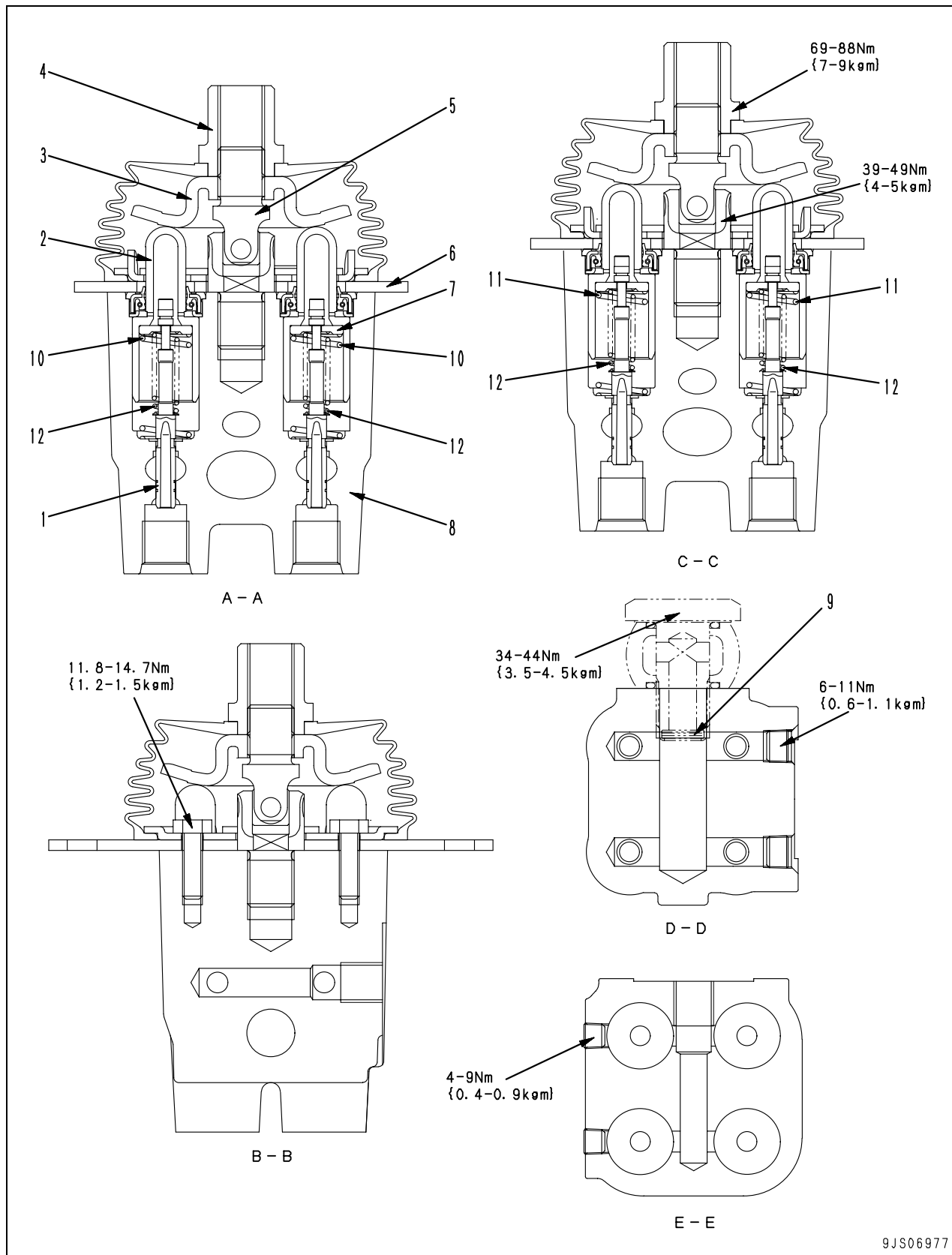
PPC valve

For work equipment and swing



- P : From pilot pump
- P1 : L.H. PPC valve: arm IN port/R.H. PPC valve: boom RAISE port
- P2 : L.H. PPC valve: arm OUT port/R.H. PPC valve: boom LOWER port
- P3 : L.H. PPC valve: swing RIGHT port/R.H. PPC valve: bucket DUMP port

- P4 : L.H. PPC valve: swing LEFT port/ R.H. PPC valve: bucket CURL port
- T : To tank



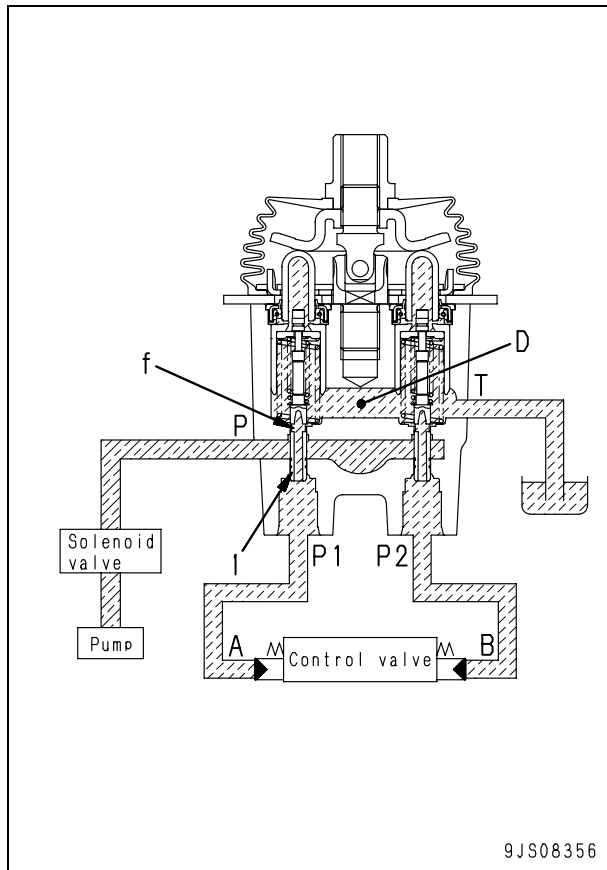
- | | |
|-------------------------------|-------------|
| 1. Spool | 6. Plate |
| 2. Piston | 7. Retainer |
| 3. Disc | 8. Body |
| 4. Nut (for connecting lever) | 9. Filter |
| 5. Joint | |

Unit: mm

No.	Check item	Criteria					Remedy
10	Centering spring (for P3, P4 port)	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		38.71 × 15.5	34	9.81 N {1 kg}	—	7.85 N {0.8 kg}	
11	Centering spring (for P1, P2 port)	42.48 × 15.5	34	17.7 N {1.8 kg}	—	14.1 N {1.44 kg}	
12	Metering spring	26.53 × 8.15	24.9	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	

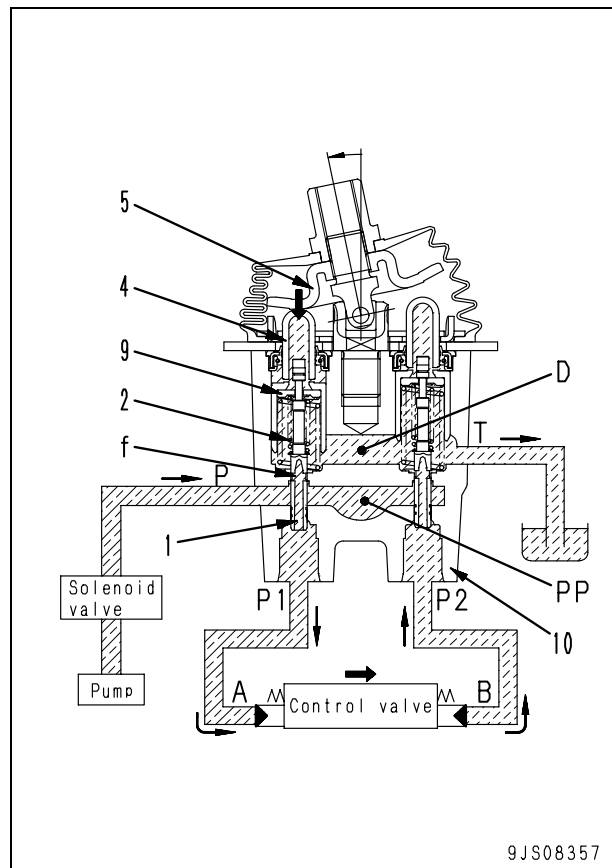
Operation**1. At neutral**

- Ports (A) and (B) of the control valve and ports (P1) and (P2) of the PPC valve are connected to drain chamber (D) through fine control hole (f) in spool (1).

**2. During fine control (neutral → fine control)**

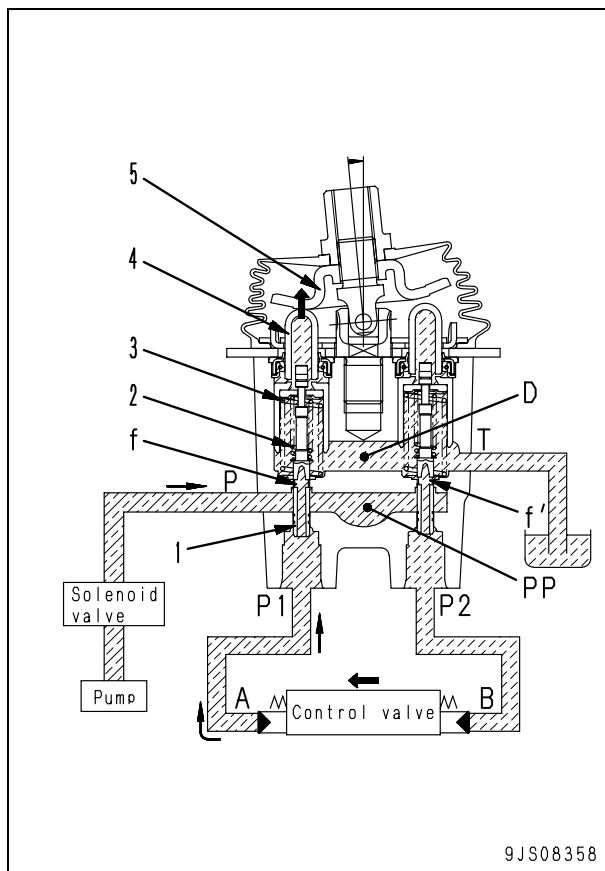
- When piston (4) starts to be pushed by disc (5), retainer (9) is pushed; spool (1) is also pushed by metering spring (2), and moves down.
- When this happens, fine control hole (f) is shut off from drain chamber (D), and at almost the same time, it is connected to pump pressure chamber (PP).
- So pilot pressure oil from the control pump passes through fine control hole (f) and goes from port (P1) to port (A).
- When the pressure at port (P1) becomes higher, spool (1) is pushed back and fine control hole (f) is shut off from pump pressure chamber (PP). At almost the same time, it is connected to drain chamber (D) to release the pressure at port (P1).

- When this happens, spool (1) moves up or down so that the force of metering spring (2) is balanced with the pressure at port (P1).
- The relationship in the position of spool (1) and body (10) (fine control hole (f) is at a point midway between drain hole (D) and pump pressure chamber (PP)) does not change until retainer (9) contacts spool (1).
- Therefore, metering spring (2) is compressed proportionally to the amount of movement of the control lever.
- So the pressure at port (P1) also rises in proportion to the travel of the control lever.
- In this way, the control valve spool moves to a position where the pressure in chamber (A) [the same as the pressure at port (P1)] and the force of the control valve spool return spring are balanced.



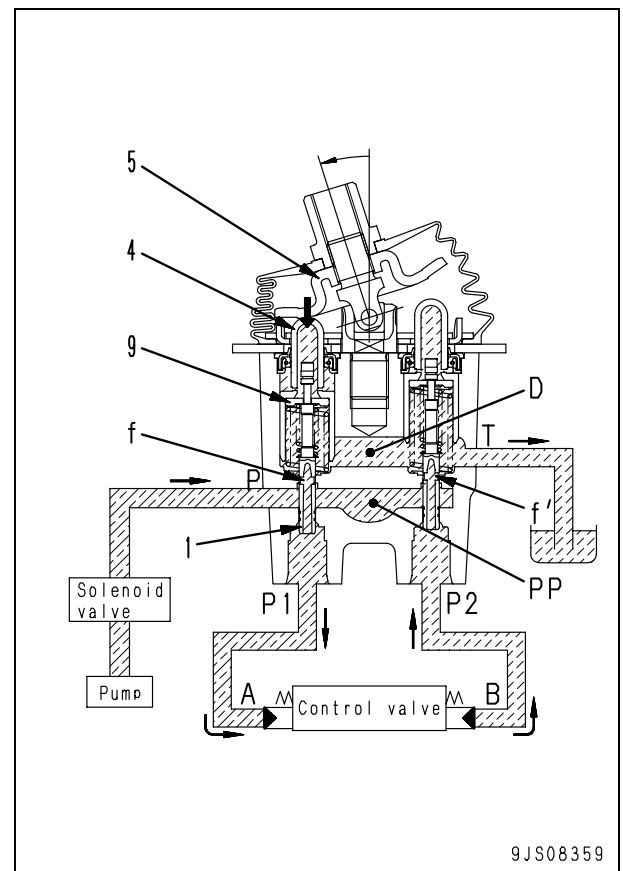
3. During fine control (when control lever is returned)

- When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port (P1).
- When this happens, fine control hole (f) is connected to drain chamber (D) and the pressure oil at port (P1) is released.
- If the pressure at port (P1) drops too far, spool (1) is pushed down by metering spring (2).
- Fine control hole (f) is shut off from drain chamber (D). At almost the same time, it is connected to pump pressure chamber (PP).
- The pump pressure is supplied until the pressure at port (P1) recovers to a pressure that corresponds to the lever position.
- When the spool of the control valve returns, oil in drain chamber (D) flows in from fine control hole (f') in the valve on the side that is not working. The oil passes through port (P2) and enters chamber (B) to fill the chamber with oil.

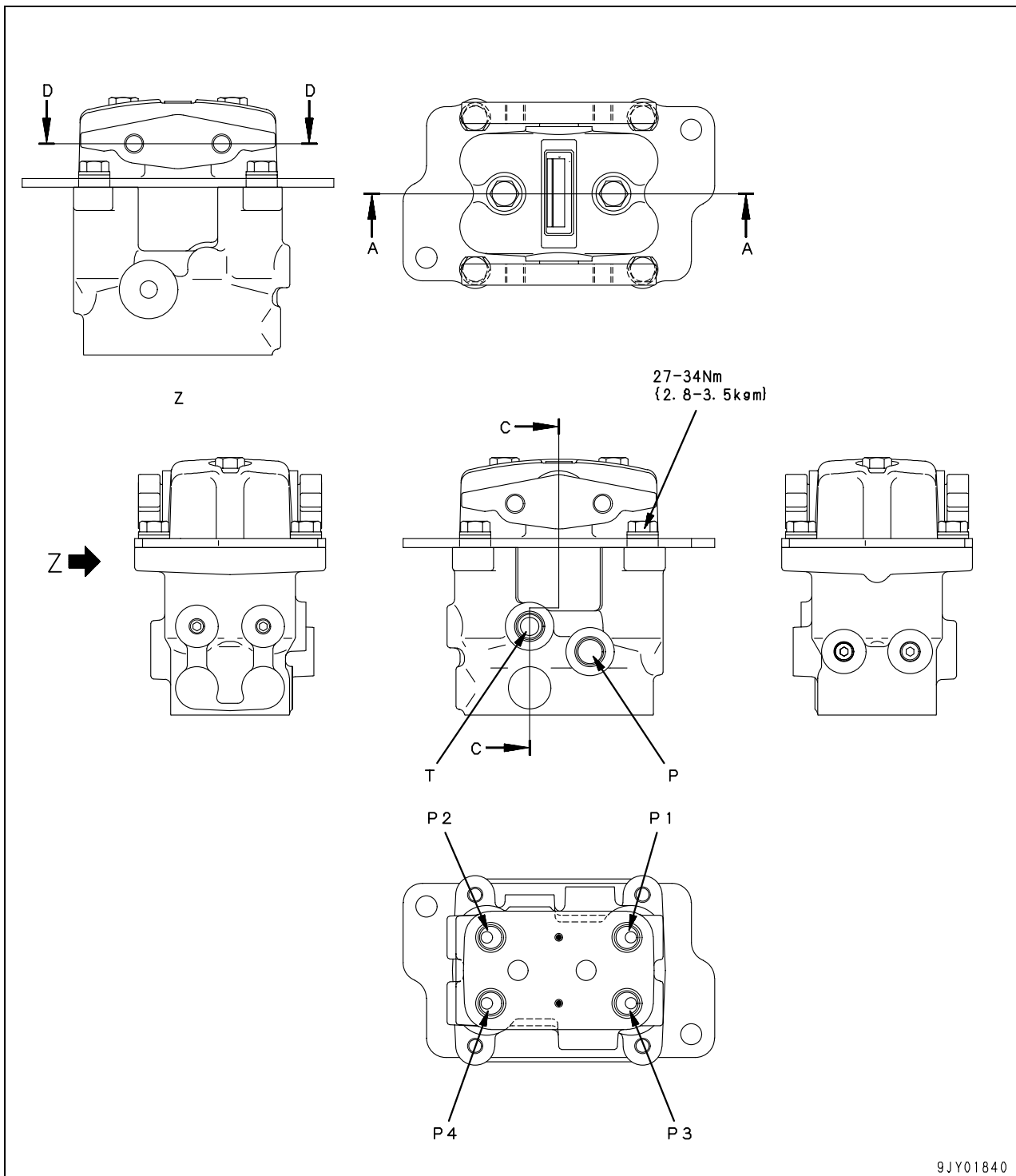


4. At full stroke

- When disc (5) pushes down piston (4), and retainer (9) pushes down spool (1).
- Fine control hole (f) is shut off from drain chamber (D), and is connected with pump pressure chamber (PP).
- Therefore, the pilot pressure from the solenoid valve passes through fine control hole (f) and flows to chamber (A) from port (P1), and pushes the control valve spool.
- The oil returning from chamber (B) passes from port (P2) through fine control hole (f') and flows to drain chamber (D).

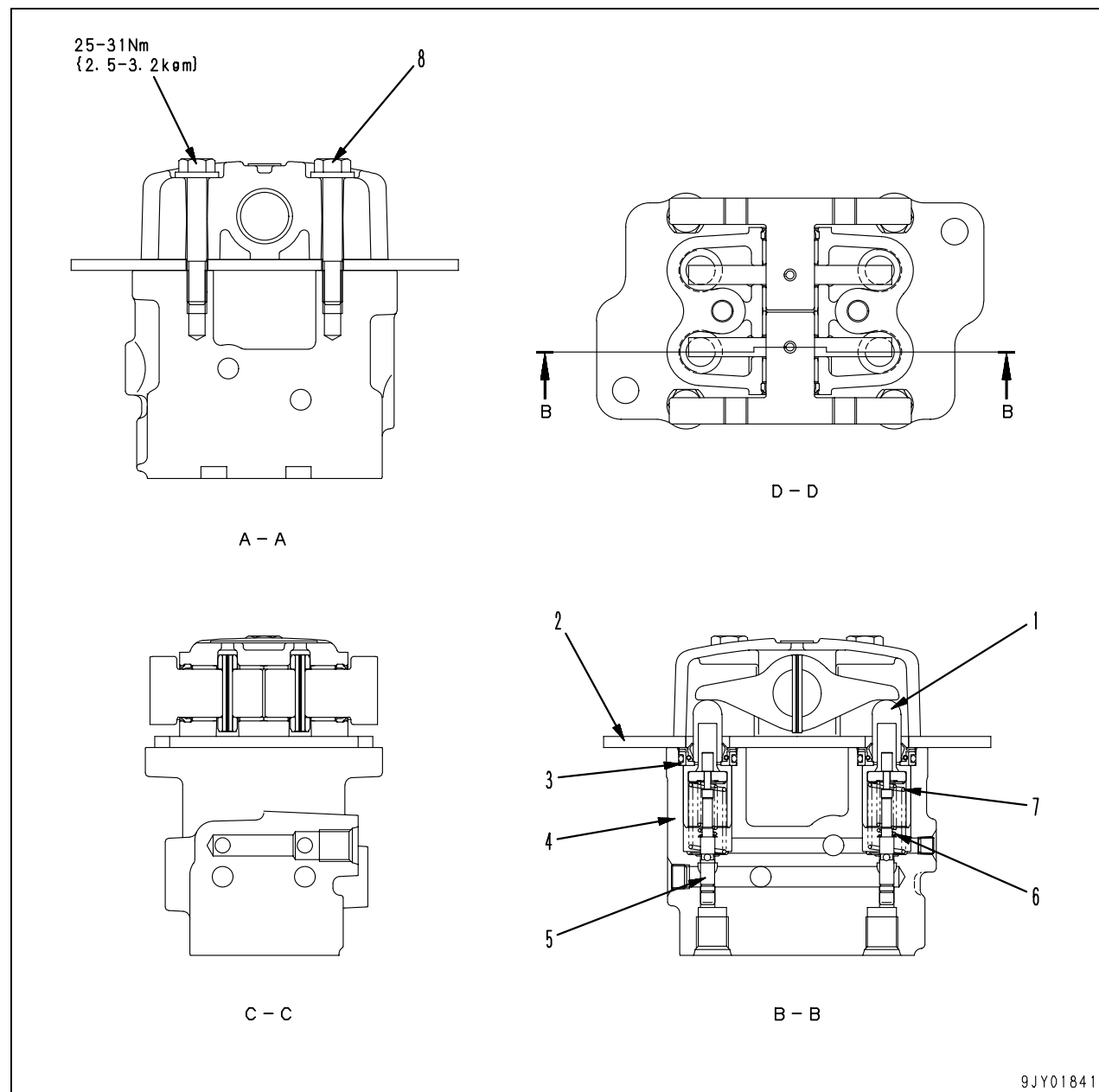


Travel PPC valve

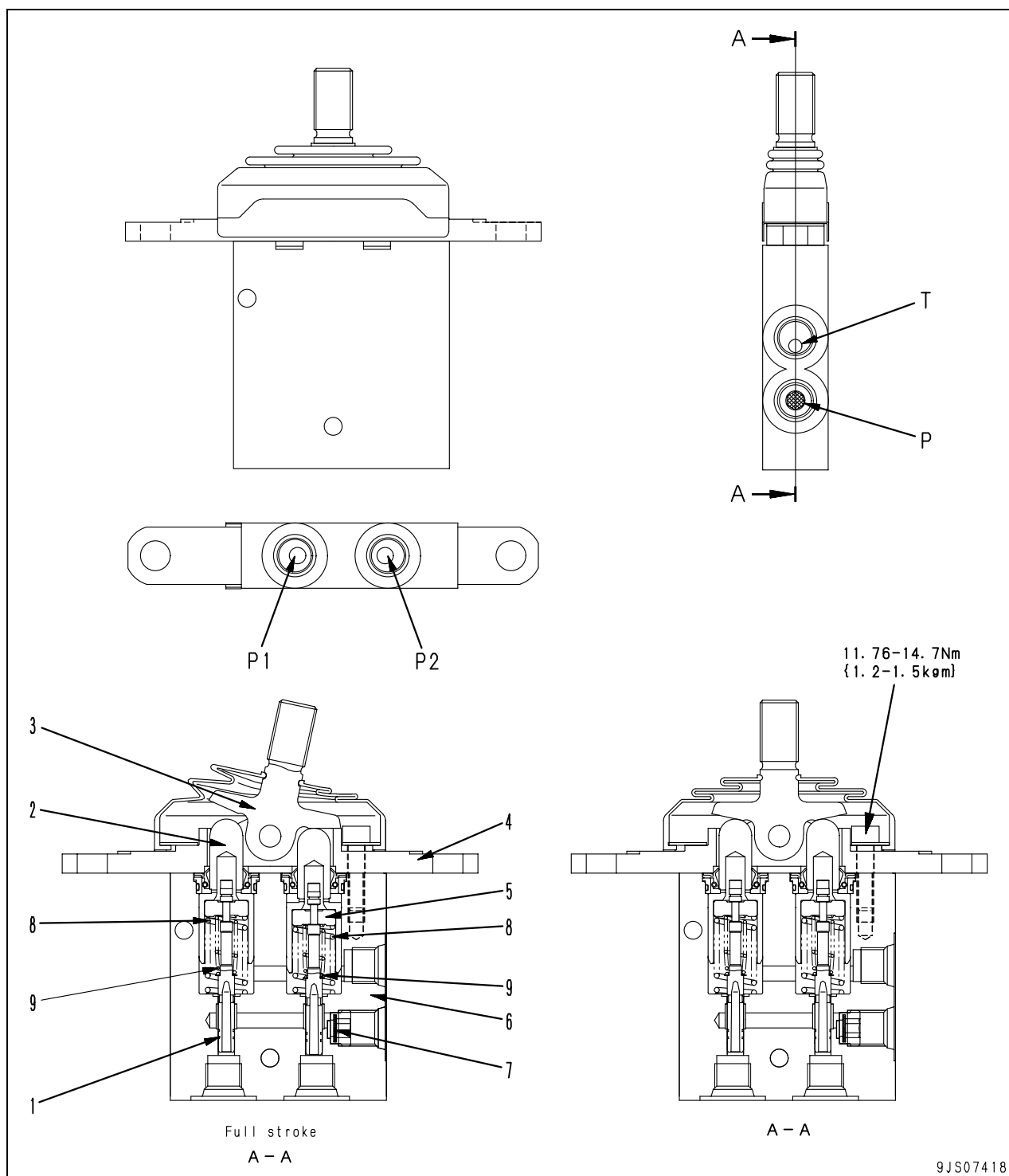


★ For operation, see the sections of the “Work equipment and swing PPC valve”.

P : From solenoid valve
 P1 : R.H. travel FORWARD port
 P2 : R.H. travel REVERSE port
 P3 : L.H. travel FORWARD port
 P4 : L.H. travel REVERSE port
 T : To tank



1. Piston
2. Plate
3. Collar
4. Body
5. Valve
6. Metering spring
7. Centering spring
8. Bolt

Blade, boom swing and attachment PPC valve

★ For operation, see the sections of the “Work equipment and swing PPC valve”.

P : From solenoid valve

P1 : To blade, boom swing and attachment valve

P2 : To blade, boom swing and attachment valve

T : To tank

1. Spool
2. Piston
3. Lever
4. Plate
5. Retainer
6. Body
7. Filter

For blade PPC valve

Unit: mm

No.	Check item	Criteria					Remedy
8	Centering spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		42.36 × 15.5	32.5	147 N {15 kg}	—	118 N {12 kg}	
9	Metering spring	22.73 × 8.1	22	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	

For boom swing, attachment PPC valve

Unit: mm

No.	Check item	Criteria					Remedy
8	Centering spring	Standard clearance			Repair limit		Replace spring if damaged or deformed
		Free length × Outside diameter	Installed length	Installed load	Free length	Installed load	
		33.88 × 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	
9	Metering spring	22.73 × 8.1	22	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04075-00

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HYDRAULIC EXCAVATOR

PC27MR-3
PC30MR-3
PC35MR-3

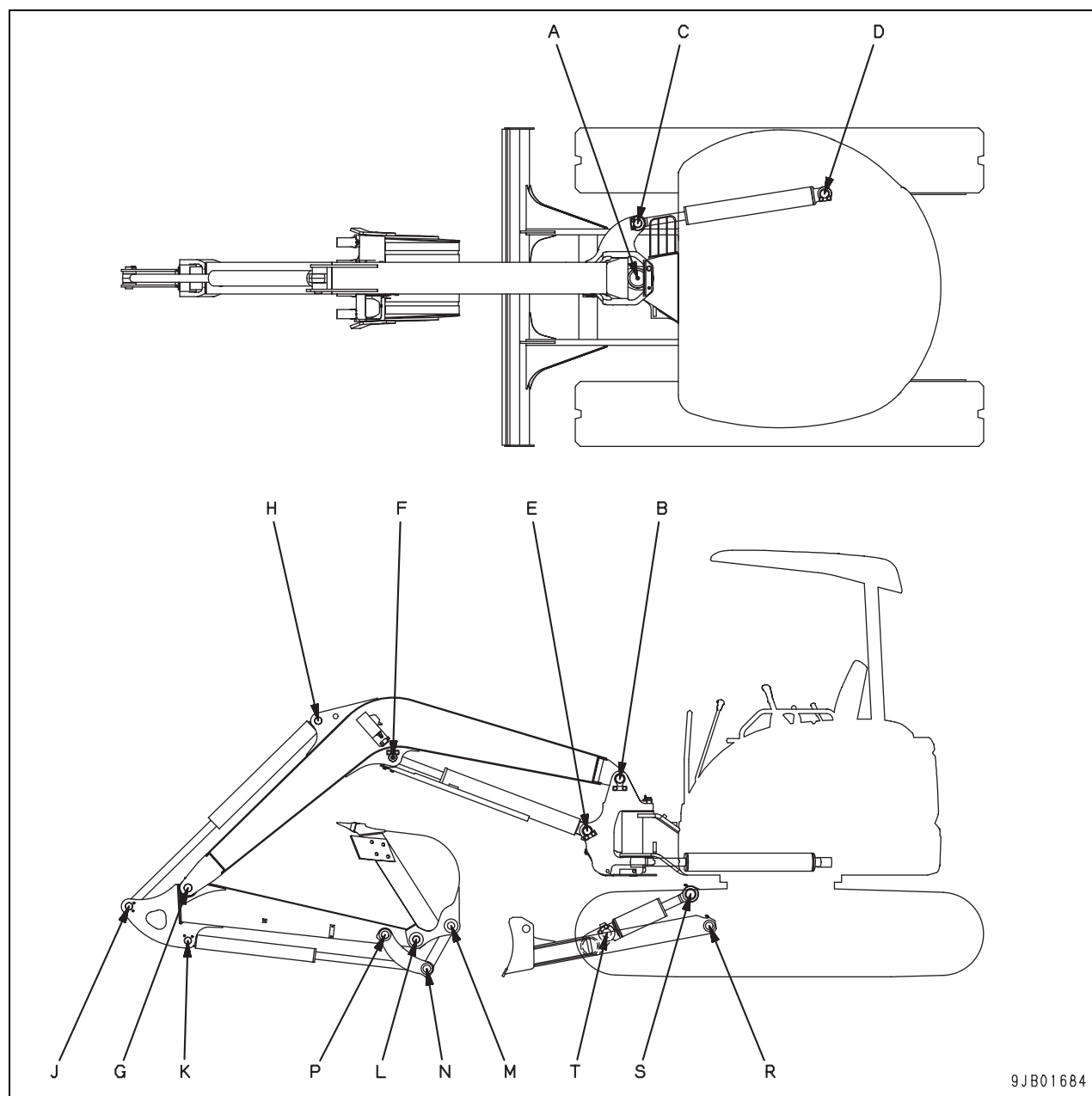
Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

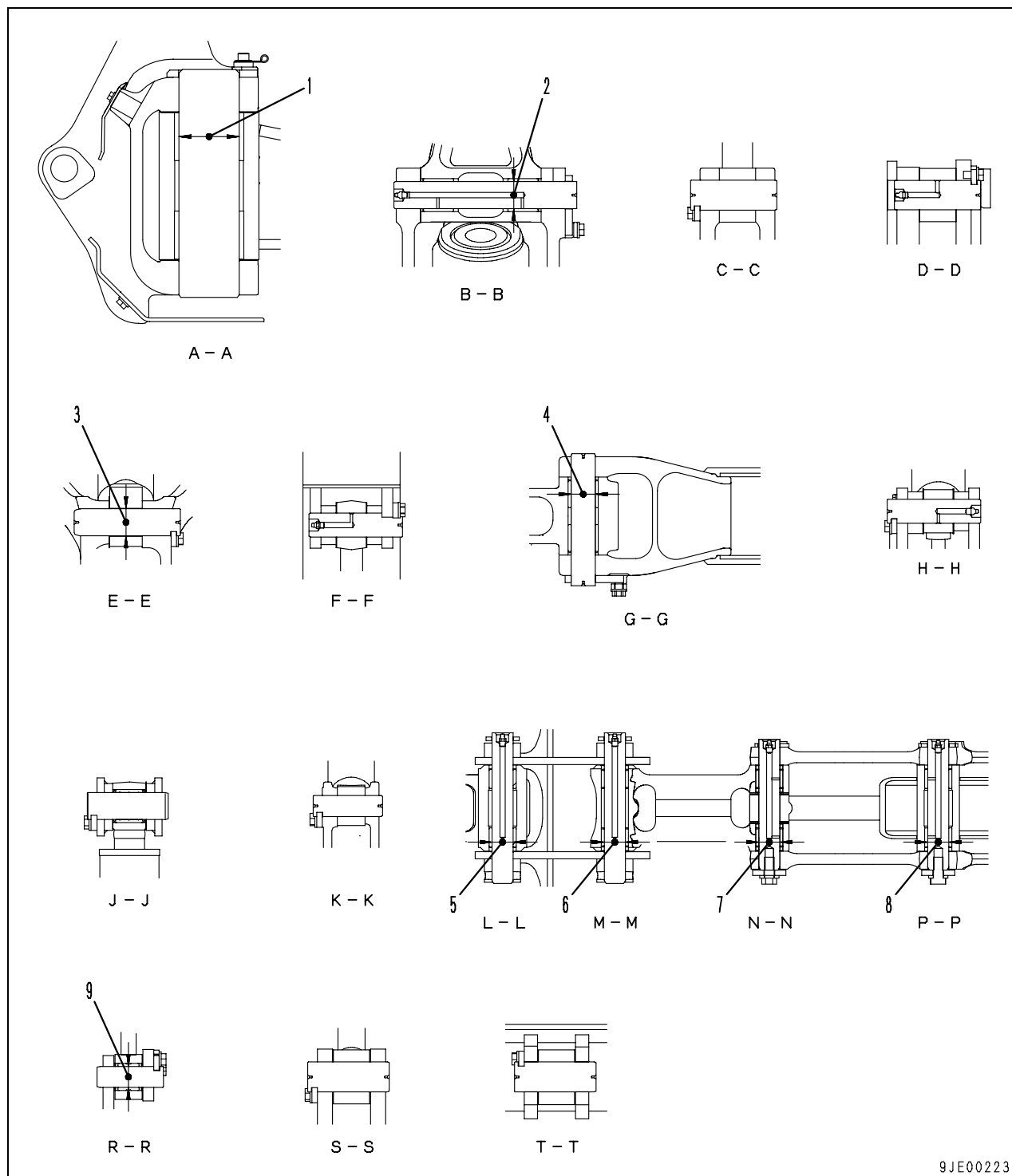
500 Work equipment

Work equipment.....	2
Dimensions of each part of work equipment.....	6

Work equipment



★ This diagram shows PC35MR.



PC27MR, PC30MR-3

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between mounting pin of revolving frame and swing bracket and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace pin and bushing
			Shaft	Hole			
		95	- 0.036 - 0.090	+ 0.134 + 0.061	0.097 – 0.224	1.0	
2	Clearance between mounting pin of swing bracket and boom and bushing	45	- 0.025 - 0.064	+ 0.081 + 0.033	0.058 – 0.145	1.0	
3	Clearance between mounting pin of swing bracket and boom cylinder and bushing	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 – 0.206	1.0	
4	Clearance between mounting pin of boom and arm and bushing	40	- 0.025 - 0.064	+ 0.088 + 0.035	0.060 – 0.152	1.0	
5	Clearance between mounting pin of arm and bucket and bushing	35	- 0.170 - 0.209	- 0.014 - 0.063	0.107 – 0.195	1.0	
6	Clearance between mounting pin of link and bucket and bushing	35	- 0.170 - 0.209	- 0.014 - 0.063	0.107 – 0.195	1.0	
7	Clearance between mounting pin of links and bushing	35	- 0.170 - 0.230	- 0.014 - 0.063	0.107 – 0.216	1.0	
8	Clearance between mounting pin of arm and link and bushing	35	- 0.170 - 0.230	- 0.014 - 0.063	0.107 – 0.216	1.0	
9	Clearance between mounting pin of track frame and blade and bushing	35	- 0.025 - 0.087	+ 0.146 + 0.095	0.020 – 0.223	1.0	

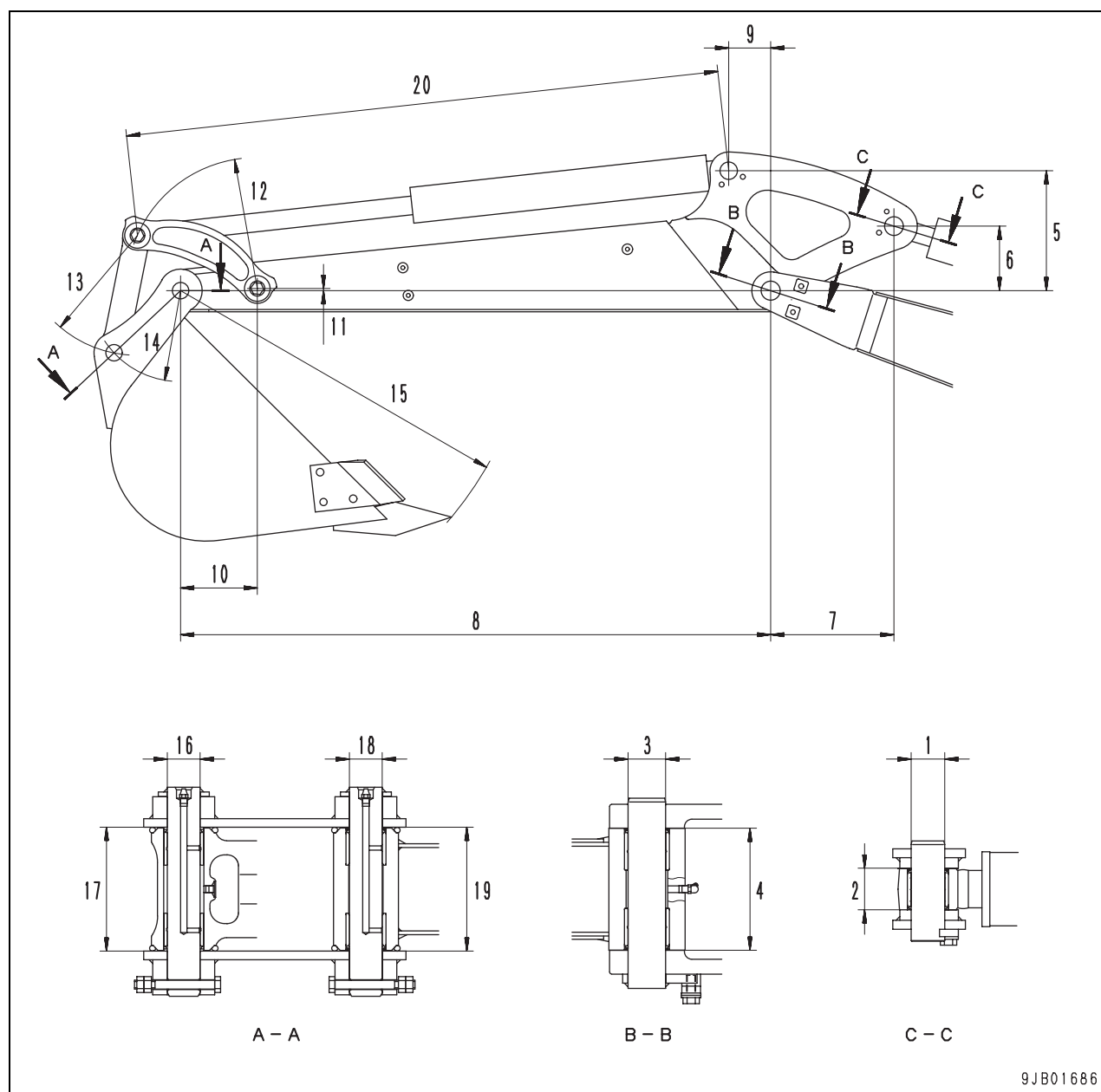
PC35MR-3

Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between mounting pin of revolving frame and swing bracket and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace pin and bushing
			Shaft	Hole			
		100	- 0.036 - 0.090	+ 0.054 0	0.036 - 0.144	1.0	
2	Clearance between mounting pin of swing bracket and boom and bushing	45	- 0.025 - 0.064	+ 0.081 + 0.033	0.058 - 0.145	1.0	
3	Clearance between mounting pin of swing bracket and boom cylinder and bushing	45	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
4	Clearance between mounting pin of boom and arm and bushing	40	- 0.025 - 0.064	+ 0.142 + 0.080	0.105 - 0.206	1.0	
5	Clearance between mounting pin of arm and bucket and bushing	35	- 0.170 - 0.209	- 0.014 - 0.063	0.107 - 0.195	1.0	
6	Clearance between mounting pin of link and bucket and bushing	35	- 0.170 - 0.209	- 0.014 - 0.063	0.107 - 0.195	1.0	
7	Clearance between mounting pin of links and bushing	35	- 0.170 - 0.230	- 0.014 - 0.063	0.107 - 0.216	1.0	
8	Clearance between mounting pin of arm and link and bushing	35	- 0.170 - 0.230	- 0.014 - 0.063	0.107 - 0.216	1.0	
9	Clearance between mounting pin of track frame and blade and bushing	35	- 0.025 - 0.087	+ 0.134 + 0.072	0.097 - 0.221	1.0	

Dimensions of each part of work equipment

Arm section (STD)



Unit: mm

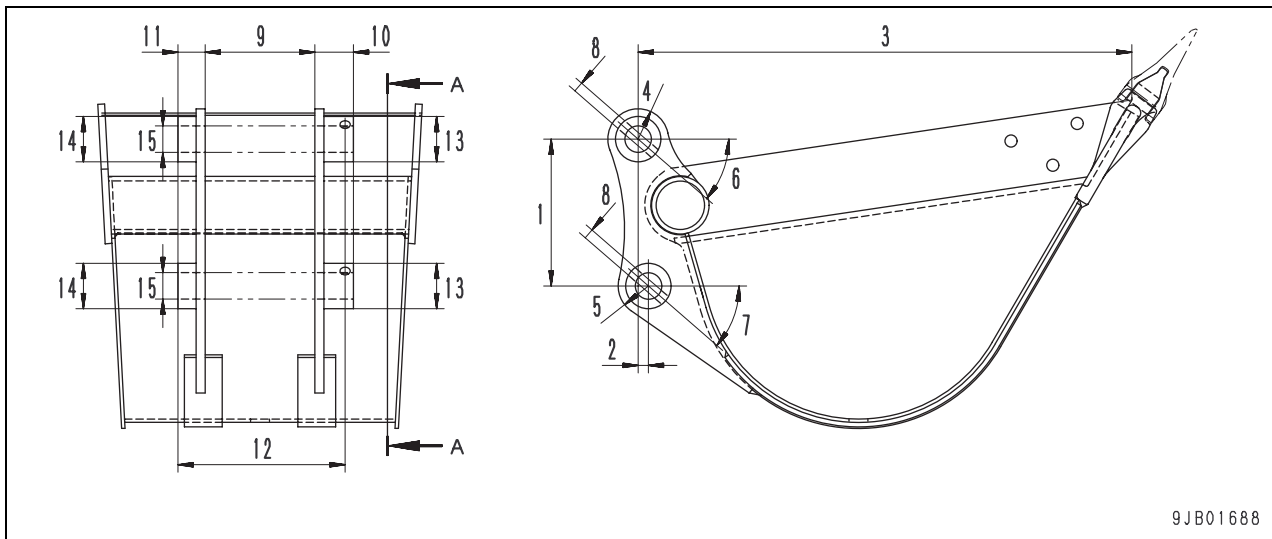
No.	PC27MR-3			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	40	-0.025 -0.064	$+0.039$ 0
2	Arm side	46	$+1$ 0	
	Cylinder head side	45	0 -0.5	
3	—	40	-0.025 -0.064	$+0.039$ 0
4	Boom side	124	$+0.5$ 0	
	Arm side	123.5	0 -0.5	
5	—	265	± 1	
6	—	163.9	± 0.5	
7	—	266.3	± 1	
8	—	1,101	± 3	
9	—	2	± 0.5	
10	—	174	± 1	
11	—	6	$+1$ 0	
12	—	265.5	± 0.5	
13	—	250.5	± 0.5	
14	—	200	± 0.2	
15	—	659	—	
16	—	35	-0.170 -0.209	-0.050 -0.089
17	Link side	143.5	0 -0.5	
	Bucket side	145	± 1	
18	—	35	-0.170 -0.209	-0.050 -0.089
19	Arm side	143.5	0 -0.5	
	Bucket side	145	± 1	
20	Min.	730	± 1	
	Max.	1,190	—	

Unit: mm

No.	PC30MR-3			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	40	-0.025 -0.064	$+0.039$ 0
2	Arm side	51	$+1$ 0	
	Cylinder head side	50	0 -0.5	
3	—	40	-0.025 -0.087	$+0.039$ 0
4	Boom side	124	$+0.5$ 0	
	Arm side	123.5	0 -0.5	
5	—	262	± 1	
6	—	138	± 1	
7	—	263	± 1	
8	—	1,240	± 3	
9	—	70.8	± 1	
10	—	163.6	± 1	
11	—	4.5	± 1	
12	—	280	± 0.5	
13	—	256	± 0.5	
14	—	194.6	± 0.2	
15	—	754	—	
16	—	35	-0.170 -0.209	-0.050 -0.089
17	Link side	143.5	0 -0.5	
	Bucket side	145	± 1	
18	—	35	-0.170 -0.209	-0.050 -0.089
19	Arm side	143.5	0 -0.5	
	Bucket side	145	± 1	
20	Min.	780	± 1	
	Max.	1,270	—	

Unit: mm

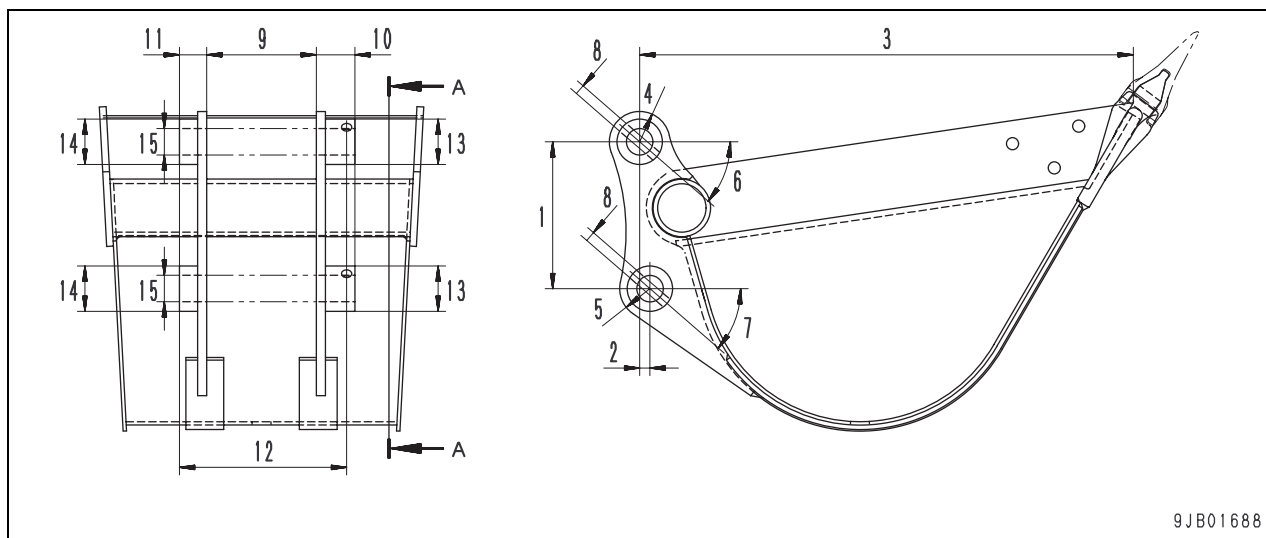
No.	PC35MR-3			
	Measuring point	Standard size	Tolerance	
			Shaft	Hole
1	—	40	-0.025 -0.064	$+0.039$ 0
2	Arm side	51	$+1$ 0	
	Cylinder head side	50	0 -0.5	
3	—	40	-0.025 -0.064	$+0.039$ 0
4	Boom side	130	$+0.5$ 0	
	Arm side	130	0 -0.5	
5	—	256.7	± 1	
6	—	120.2	± 1	
7	—	335	± 1	
8	—	1,370	± 3	
9	—	193.7	± 1	
10	—	163.4	± 1	
11	—	9.6	± 1	
12	—	280	± 0.5	
13	—	256	± 0.5	
14	—	194.6	± 0.5	
15	—	754	—	
16	—	35	-0.170 -0.209	0 -0.040
17	Link side	143.5	0 -0.5	
	Bucket side	145	± 1	
18	—	35	-0.170 -0.209	0 -0.040
19	Arm side	143.5	0 -0.5	
	Bucket side	145	± 1	
20	Min.	780	± 1	
	Max.	1,270	—	

Bucket section
PC27MR-3

Unit: mm

No.	PC27MR-3		
	Measuring point	Standard size	Tolerance
1	—	199.9	—
2	—	6.3	—
3	—	567	—
4	—	42	—
5	—	42	—
6	—	45°	—
7	—	45°	—
8	—	13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	60	—
14	—	60	—
15	—	35	- 0.050 - 0.089

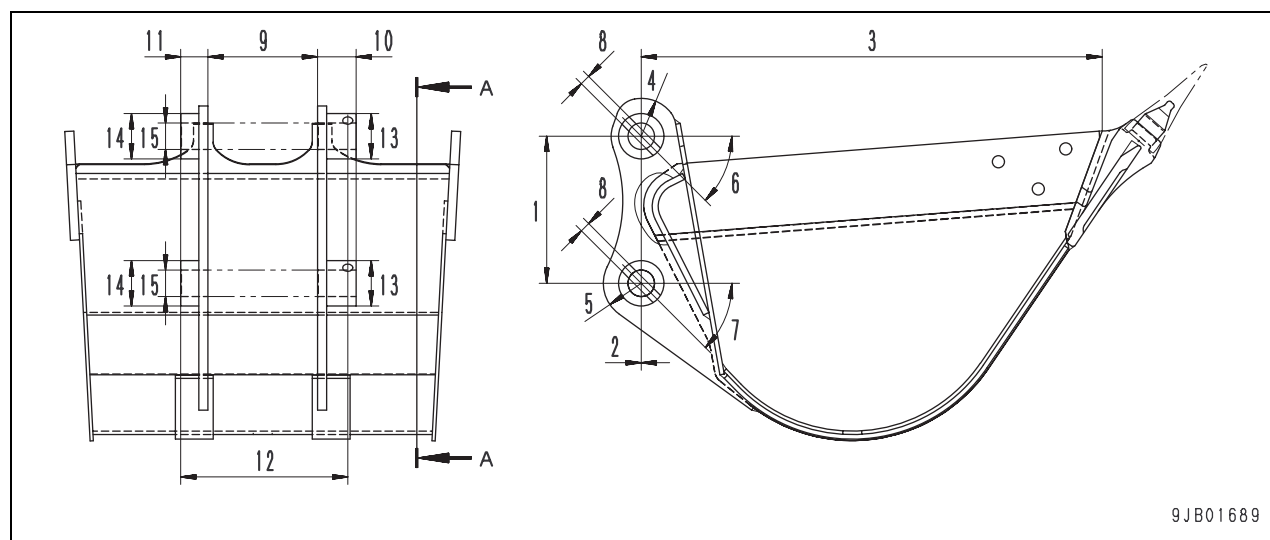
PC30MR-3



9JB01688

Unit: mm

No.	PC30MR-3		
	Measuring point	Standard size	Tolerance
1	—	194	—
2	—	13.6	—
3	—	653	—
4	—	40	—
5	—	40	—
6	—	49°	—
7	—	45°	—
8	—	13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	60	—
14	—	60	—
15	—	35	- 0.050 - 0.089

PC35MR-3

Unit: mm

No.	PC35MR-3		
	Measuring point	Standard size	Tolerance
1	—	194.6	± 0.5
2	—	0	—
3	—	609.5	—
4	—	50	—
5	—	50	—
6	—	45°	—
7	—	45°	—
8	—	13.5	—
9	—	145	± 1
10	—	51	—
11	—	36	—
12	—	221	± 1
13	—	60	—
14	—	60	—
15	—	35	$\begin{matrix} 0 \\ -0.040 \end{matrix}$

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04076-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

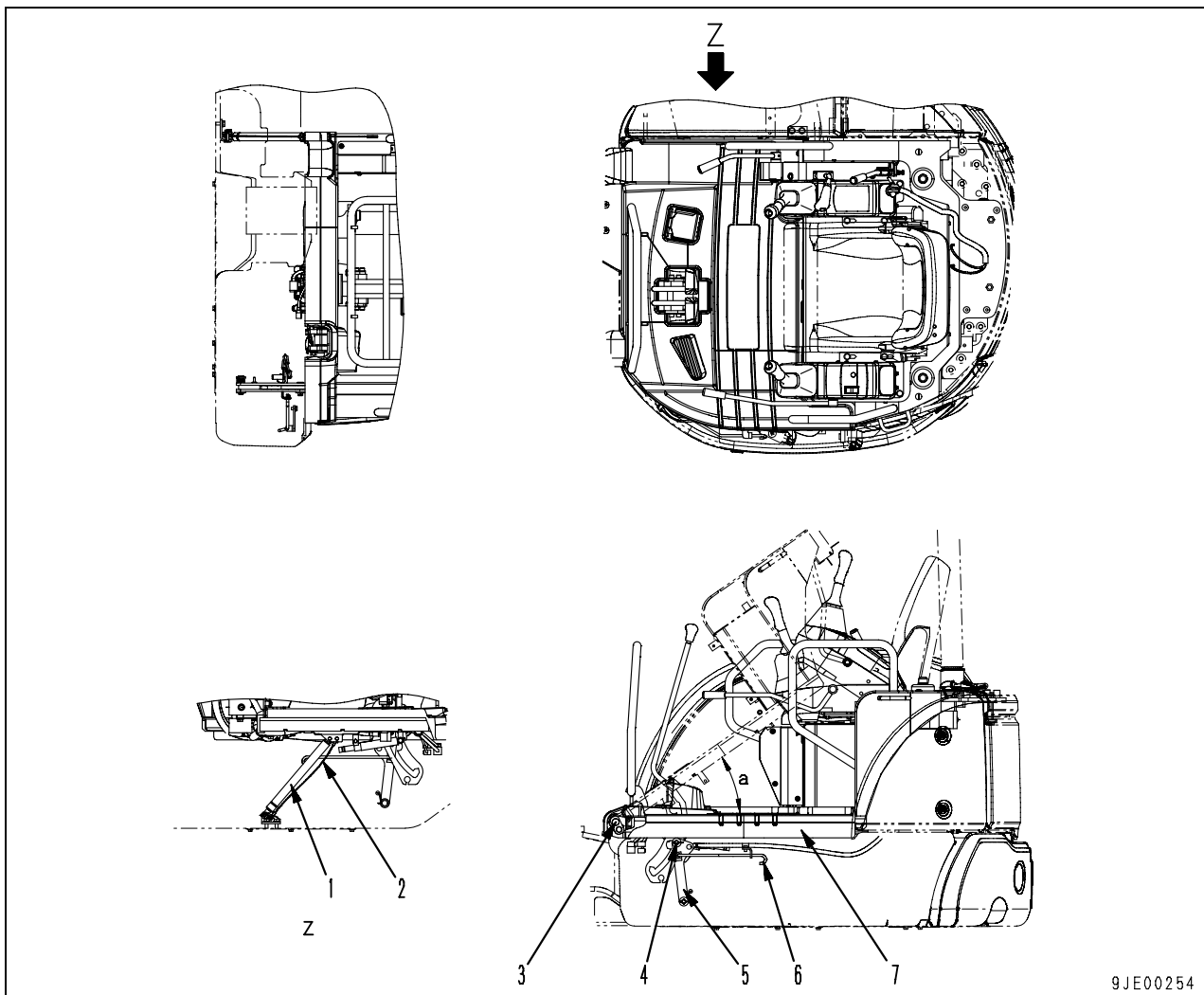
10 Structure, function and maintenance standard

600 Cab and its attachments

Floor	2
Air conditioner	3

Floor

Tilt floor



9JE00254

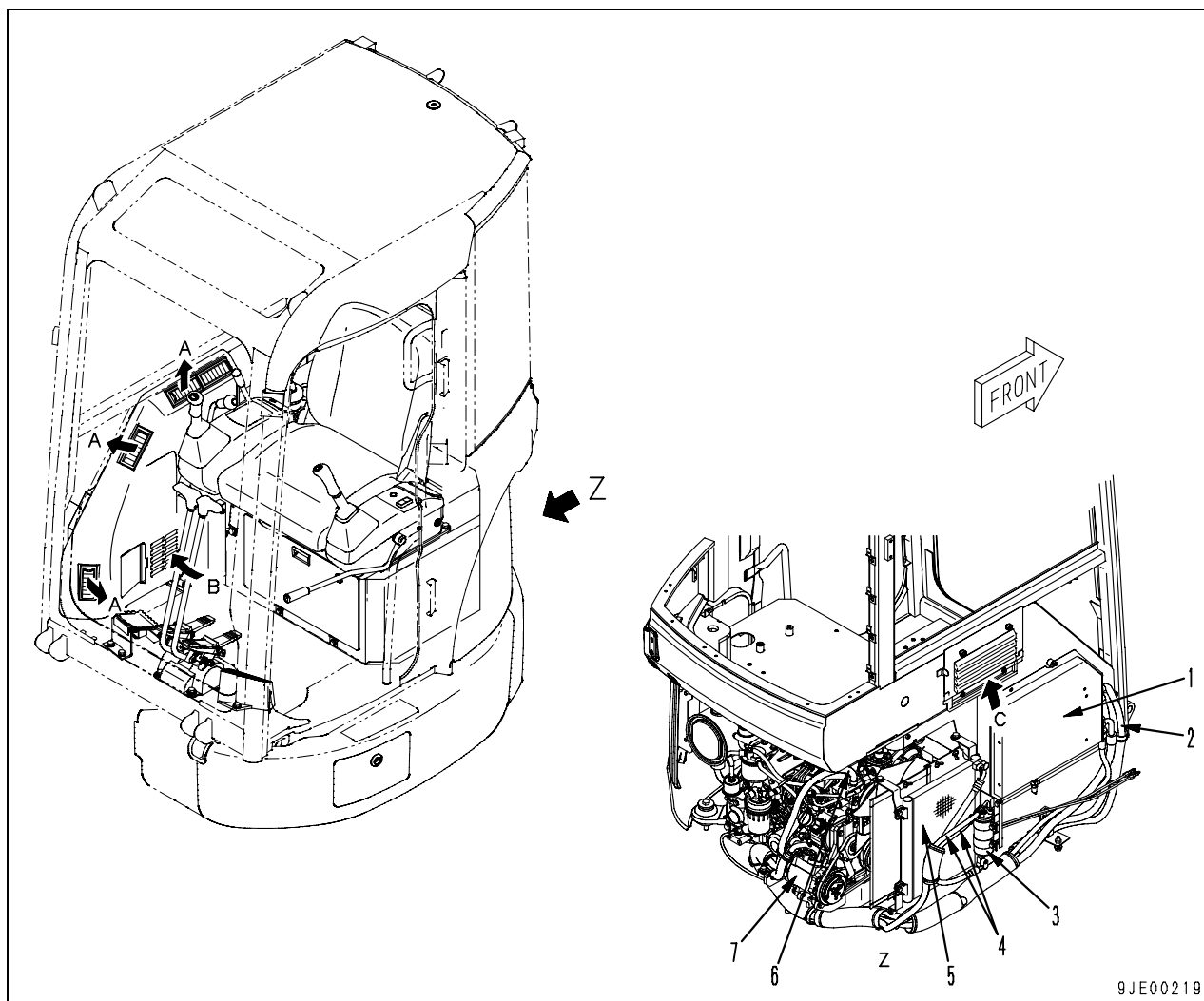
1. Gas spring
2. Wire
3. Hinge pin
4. Lock pin
5. Tilt lock bracket
6. Reset lever
7. Floor assembly

Outline

- The tilt floor can be tilted open for the ease of adjusting of the fan belt, inspection and maintenance such as replacement of the hydraulic hoses, etc.
Tilt open angle (a): Approx. 35°

Air conditioner

Air conditioner piping



A: Hot/Cold air outlet
B: Inside air circulation opening
C: Fresh air intake opening

1. Air conditioner unit
2. Return hot water piping
3. Receiver drier
4. Refrigerant piping
5. Condenser
6. Hot water take-off piping
7. Air conditioner compressor

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04077-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

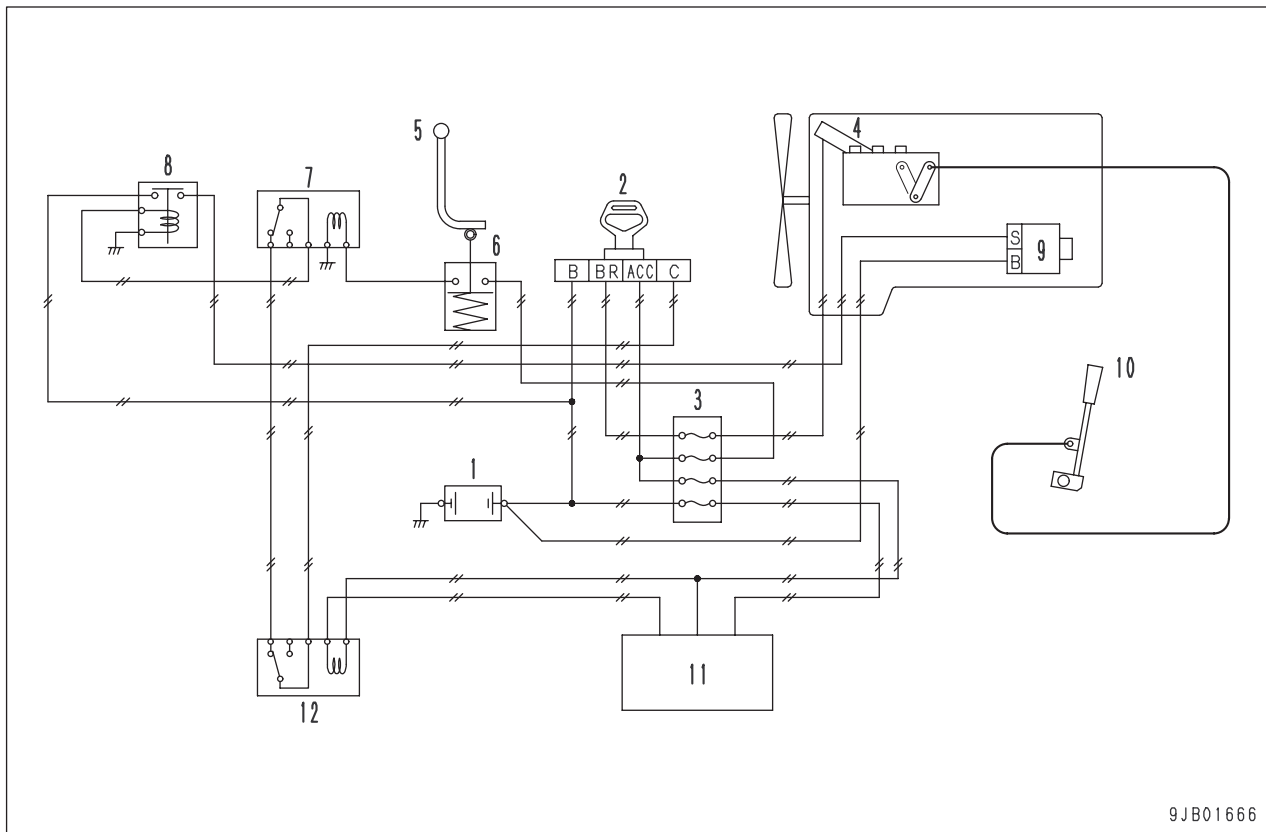
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

10 Structure, function and maintenance standard

700 Electrical system

Engine control system.....	2
Electric control system	6
Auto-deceleration function	16
Attachment proportional switch, breaker operation switch, work mode selection, flow control function	20
KOMTRAX system.....	30
Component parts of system	33
Monitor system.....	34
Sensors	38

Engine control system



1. Battery
2. Starting switch
3. Fuse box
4. Engine stop solenoid
5. Lock lever
6. PPC lock switch
7. Neutral engine start relay
8. Safety relay
9. Starting motor
10. Fuel control lever
11. KOMTRAX controller
12. KOMTRAX engine cut-out relay

Starting engine

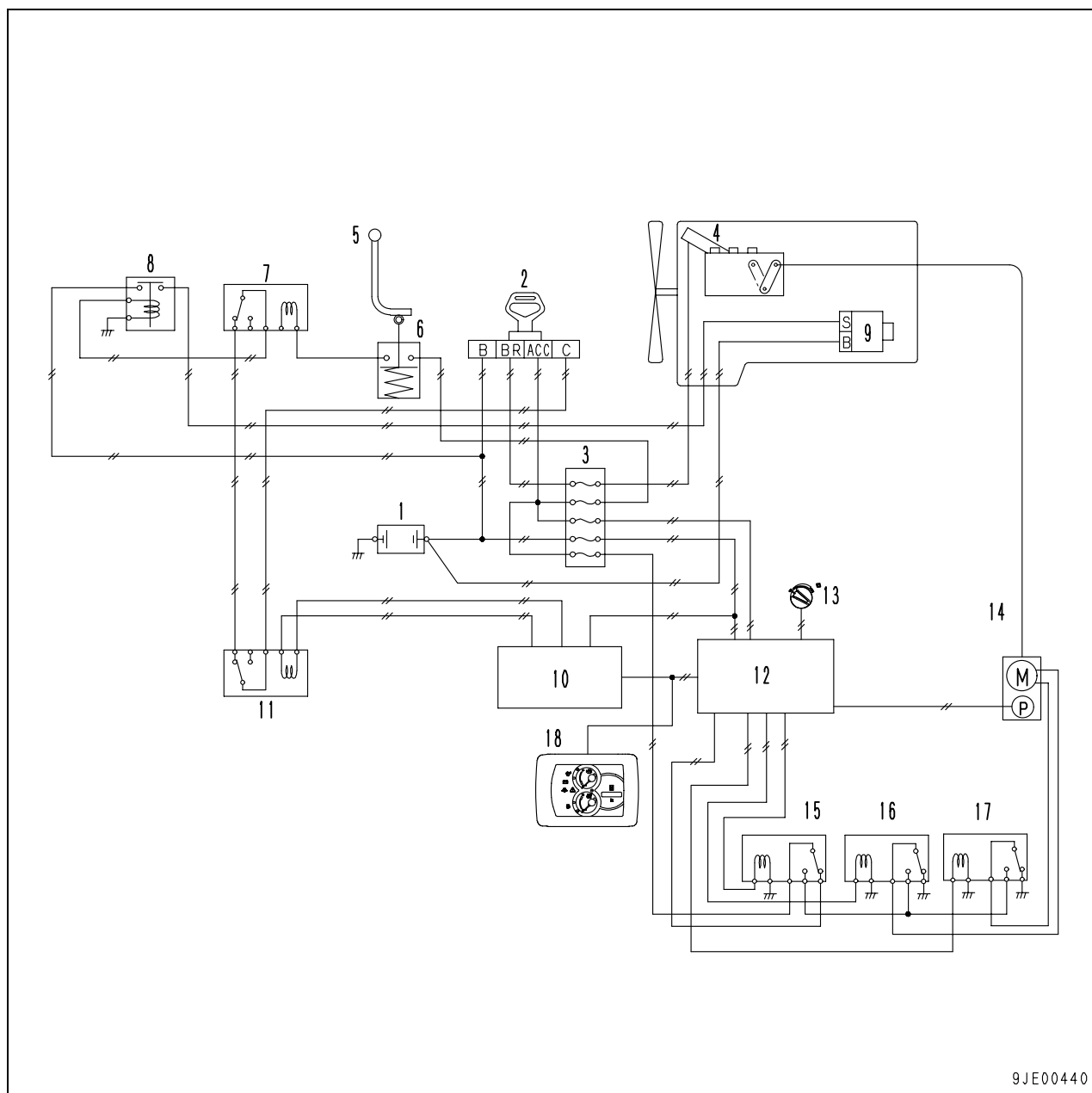
- If starting switch (2) is set to the "ON" position, engine stop solenoid (4) sets the governor stop lever to the "RUN" position. Accordingly, if the electric system has a failure, the engine stops, that is, a fail-safe mechanism is formed.
- If starting switch (2) is set to the "START" position while lock lever (5) is in the "LOCK" position, the start signal flows in starting motor (9) and the engine starts. If lock lever (5) is in the "FREE" position, neutral engine start relay (7) operates to shut off the start signal to starting motor (9), thus the engine does not start.
- If the machine is equipped with the KOMTRAX terminal system and receives an engine cut-out command generated by an external operation, KOMTRAX controller (11) turns KOMTRAX engine cut-out relay (12) ON to shut off the current to starting motor (9), thus the engine cannot start.

Engine speed control

- If fuel control lever (10) is operated, the cable is extended or retracted to control the engine speed.

Stopping engine

- If starting switch (2) is set to the "OFF" position, engine stop solenoid (4) sets the governor stop lever to the "STOP" position to stop the engine.

(Auto-deceleration specification)

- | | |
|-------------------------------|---|
| 1. Battery | 10. KOMTRAX terminal |
| 2. Starting switch | 11. KOMTRAX engine cut-out relay |
| 3. Fuse box | 12. Controller |
| 4. Engine stop solenoid | 13. Fuel control dial |
| 5. Lock lever | 14. Fuel control motor |
| 6. PPC lock switch | 15. Fuel control motor relay (For driving) |
| 7. Neutral engine start relay | 16. Fuel control motor relay (For acceleration) |
| 8. Safety relay | 17. Fuel control motor relay (For deceleration) |
| 9. Starting motor | 18. Machine monitor |

Starting engine

- If starting switch (2) is set to the "ON" position, engine stop solenoid (4) sets the governor stop lever to the "RUN" position. Accordingly, if the electric system has a failure, the engine stops, that is, a fail-safe mechanism is formed.
- If starting switch (2) is set to the "START" position while lock lever (5) is in the "LOCK" position, the start signal flows in starting motor (9) and the engine starts.
If lock lever (5) is in the "FREE" position, neutral engine start relay (7) operates to shut off the start signal to starting motor (9), thus the engine does not start.
- If the machine is equipped with the KOMTRAX terminal system and receives an engine cut-out command generated by an external operation, KOMTRAX terminal (10) turns KOMTRAX engine cut-out relay (11) ON to shut off the current to starting motor (9), thus the engine cannot start.

Controlling engine speed

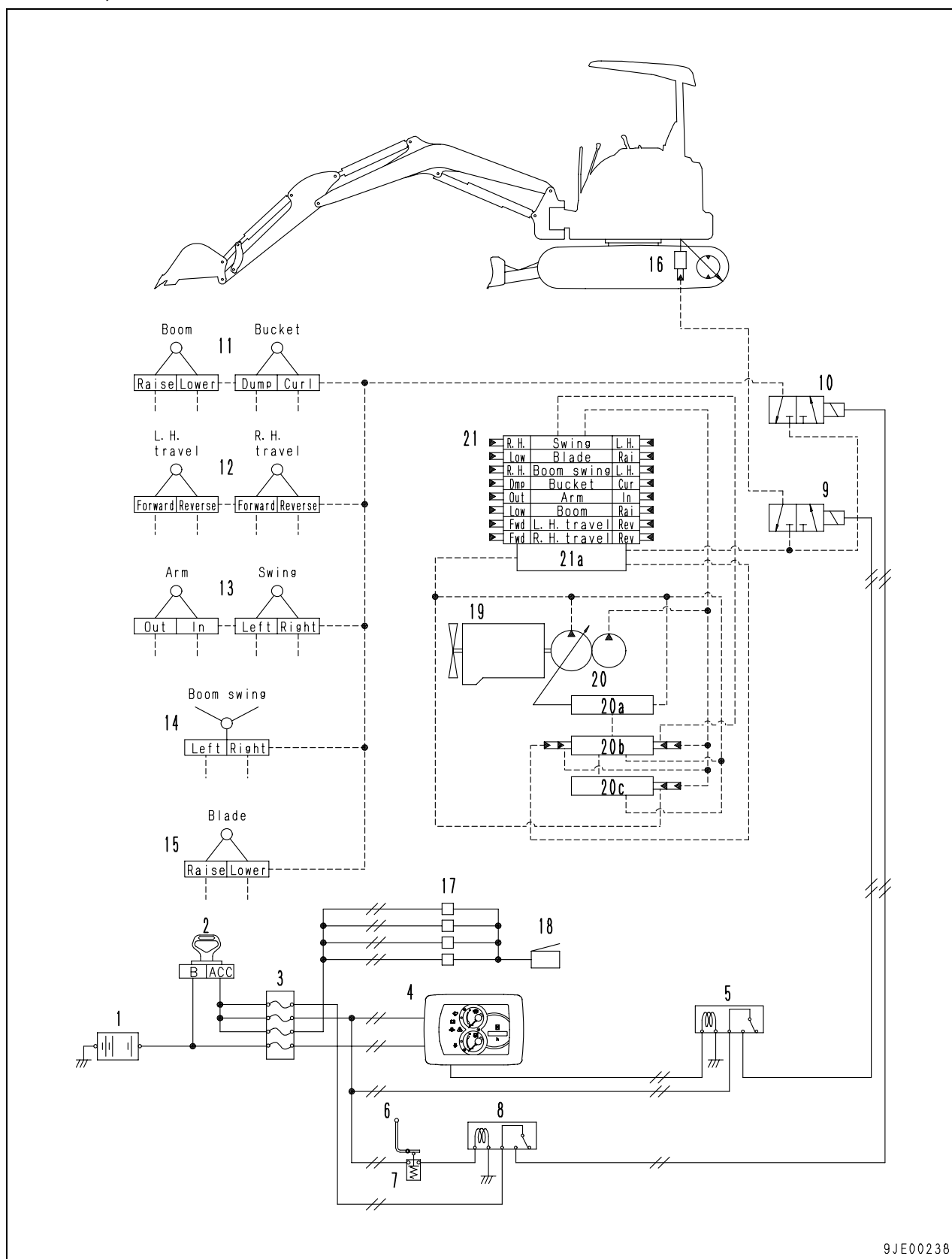
- Fuel control motor (14) outputs the acceleration (engine speed raising) signal and deceleration (engine speed lowering) signal to controller (12) according to the position of fuel control dial (13).
- Upon receiving the signal, controller (12) outputs the drive signal through fuel control motor relays (15), (16), and (17) to fuel control motor (14).
- Fuel control motor (14) lengthens or shortens the cable to control the engine speed

Stopping engine

- If starting switch (2) is set to the "OFF" position, engine stop solenoid (4) sets the governor stop lever to the "STOP" position to stop the engine.

Electric control system**General system drawing**

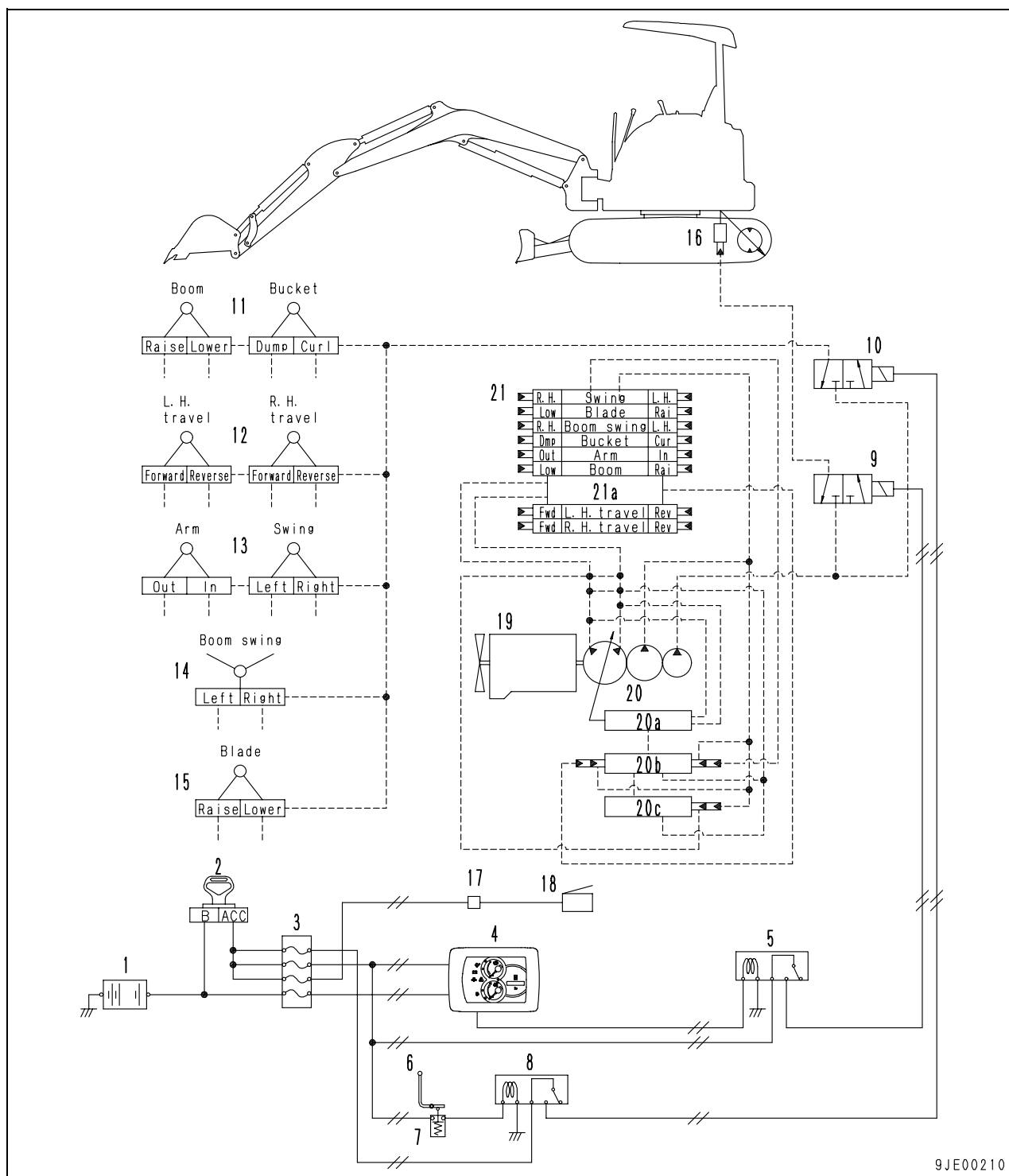
PC27MR-3, PC30MR-3



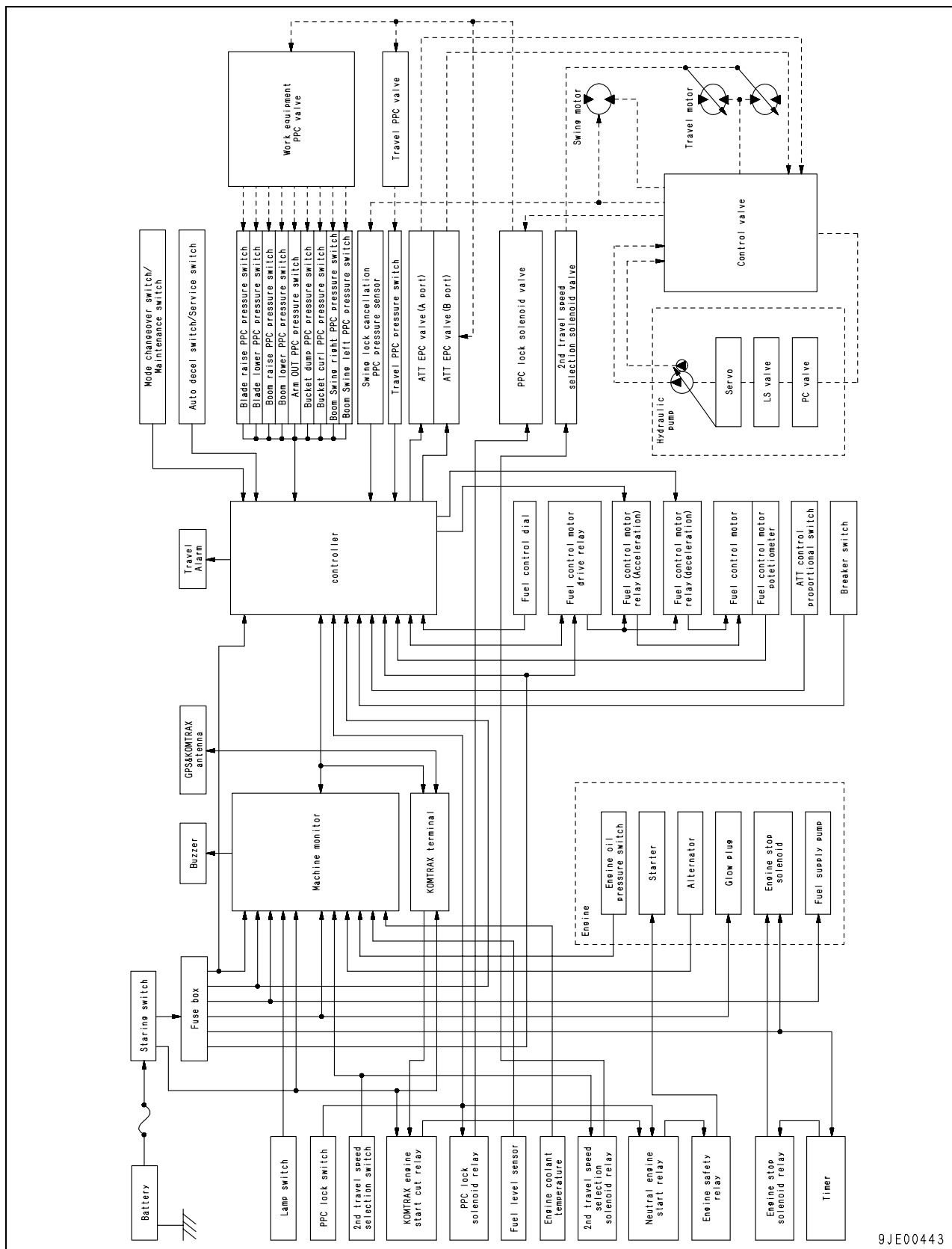
9JE00238

1. Battery
2. Starting switch
3. Fuse box
4. Machine monitor
5. 2nd travel speed selector solenoid relay
6. Lock lever
7. PPC lock switch
8. PPC lock solenoid relay
9. 2nd travel speed selector solenoid valve
10. PPC lock solenoid valve
11. Right work equipment PPC valve
12. Travel PPC valve
13. Left work equipment PPC valve
14. Boom swing PPC valve
15. Blade PPC valve
16. Travel motor
17. Travel pressure switch
18. Travel alarm
19. Engine
20. Hydraulic pump
 - 20a. Servo valve
 - 20b. LS valve
 - 20c. PC valve
21. Control valve
 - 21a. Self-pressure reducing valve

PC35MR-3



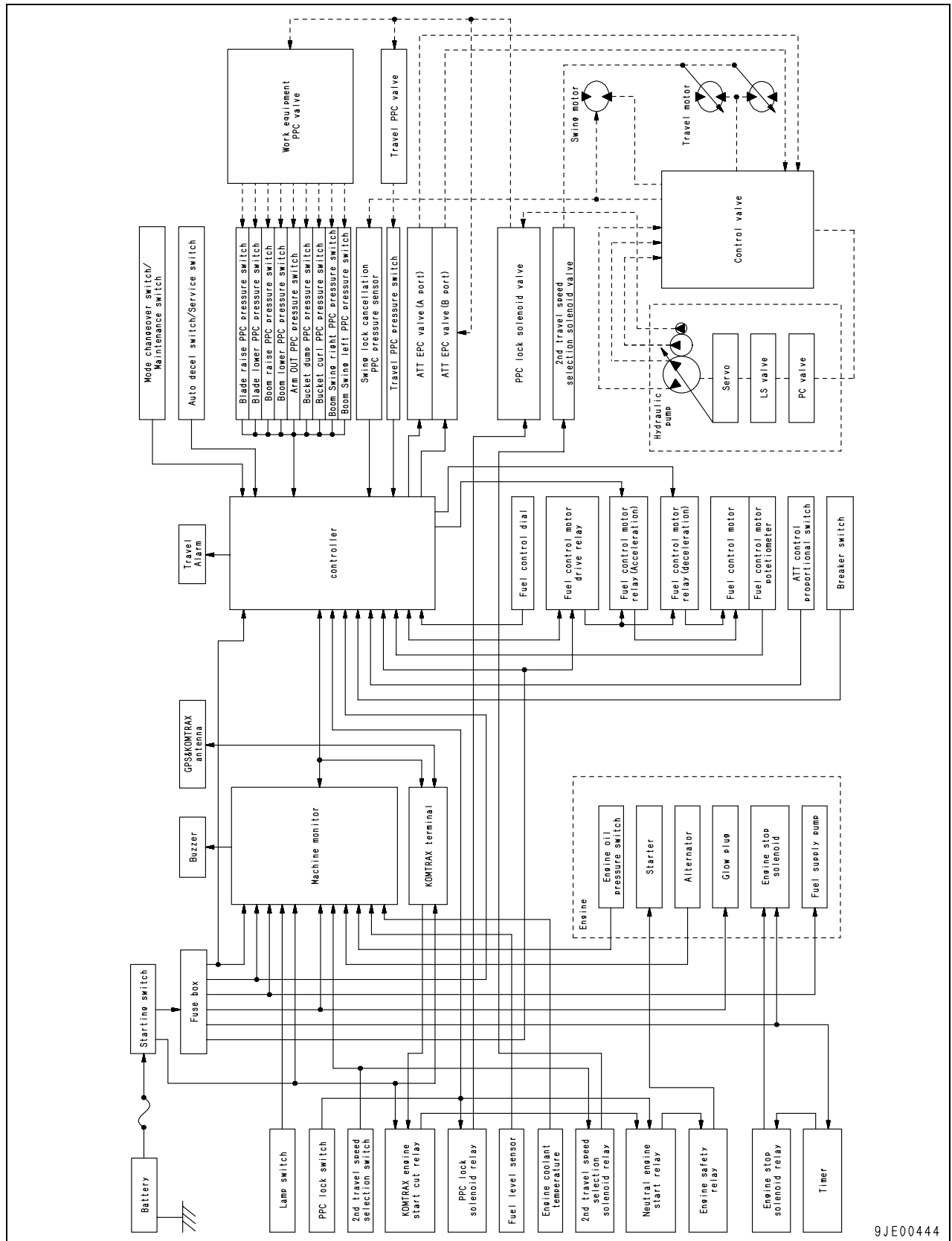
1. Battery
2. Starting switch
3. Fuse box
4. Machine monitor
5. 2nd travel speed selector solenoid relay
6. Lock lever
7. PPC lock switch
8. PPC lock solenoid relay
9. 2nd travel speed selector solenoid valve
10. PPC lock solenoid valve
11. Right work equipment PPC valve
12. Travel PPC valve
13. Left work equipment PPC valve
14. Boom swing PPC valve
15. Blade PPC valve
16. Travel motor
17. Travel pressure switch
18. Travel alarm
19. Engine
20. Hydraulic pump
 - 20a. Servo valve
 - 20b. LS valve
 - 20c. PC valve
21. Control valve
 - 21a. Self-pressure reducing valve

(Attachment switch, auto-deceleration specification)
PC27MR-3

9JE00443

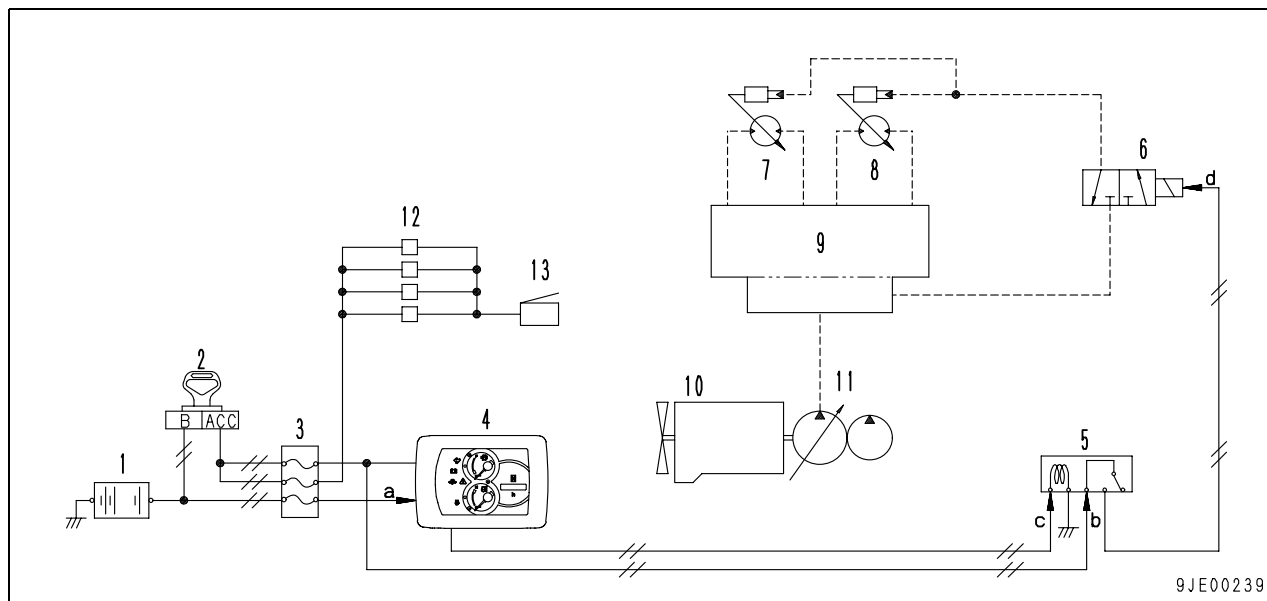
(Attachment switch, auto-deceleration specification)

PC35MR-3

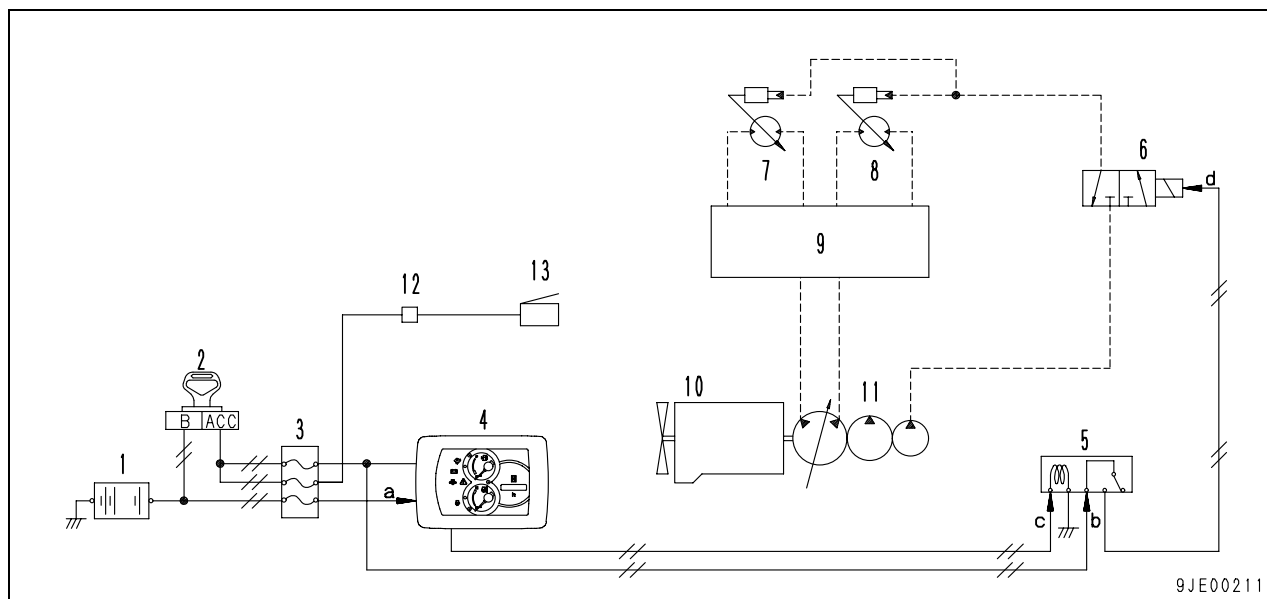


Travel control function

PC27MR-3, PC30MR-3



PC35MR-3



1. Battery
2. Starting switch
3. Fuse box
4. Machine monitor
5. 2nd travel speed selector solenoid relay
6. 2nd travel speed selector solenoid valve
7. Left travel motor
8. Right travel motor
9. Control valve
10. Engine
11. Hydraulic pump
12. Travel pressure switch
13. Travel alarm

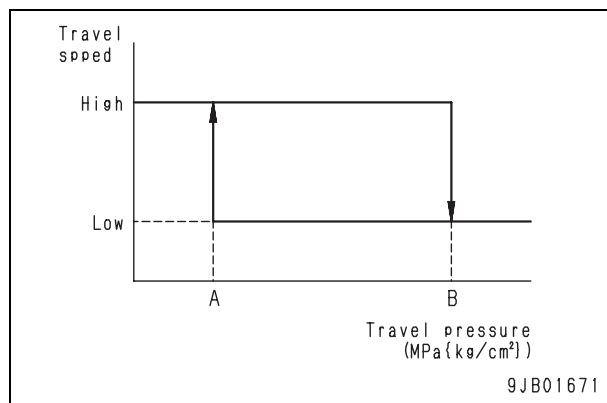
Input and output signals

- a. Machine monitor power supply
- b. Solenoid power supply
- c. 2nd travel speed selector signal
- d. Solenoid valve drive signal

Function

Changing travel speed

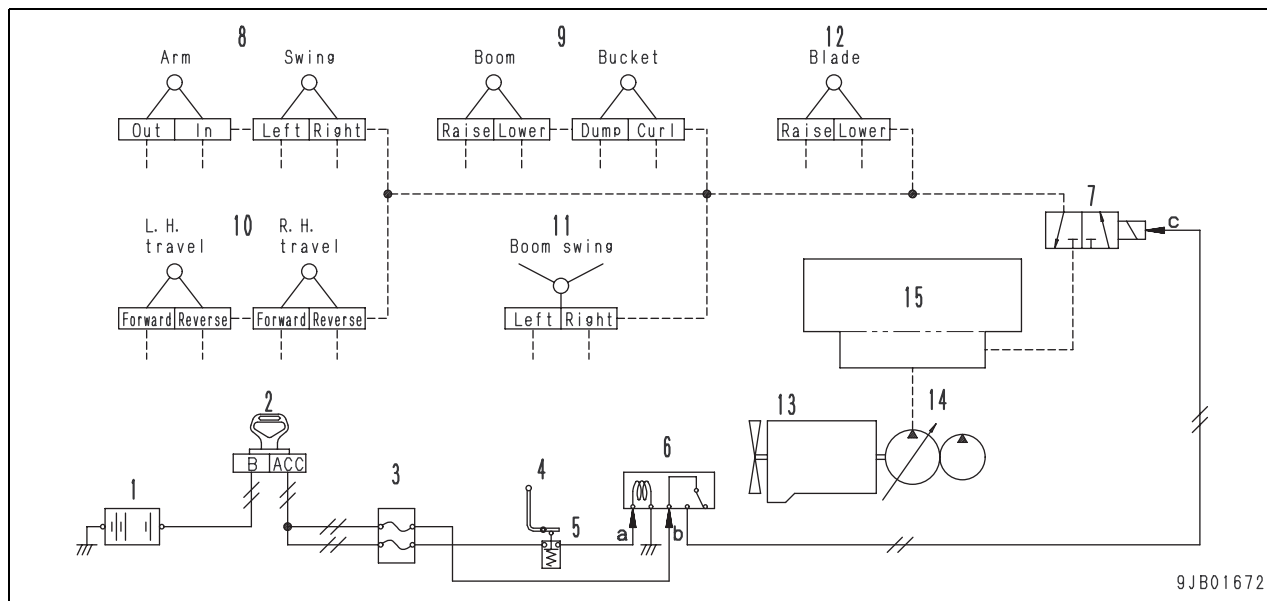
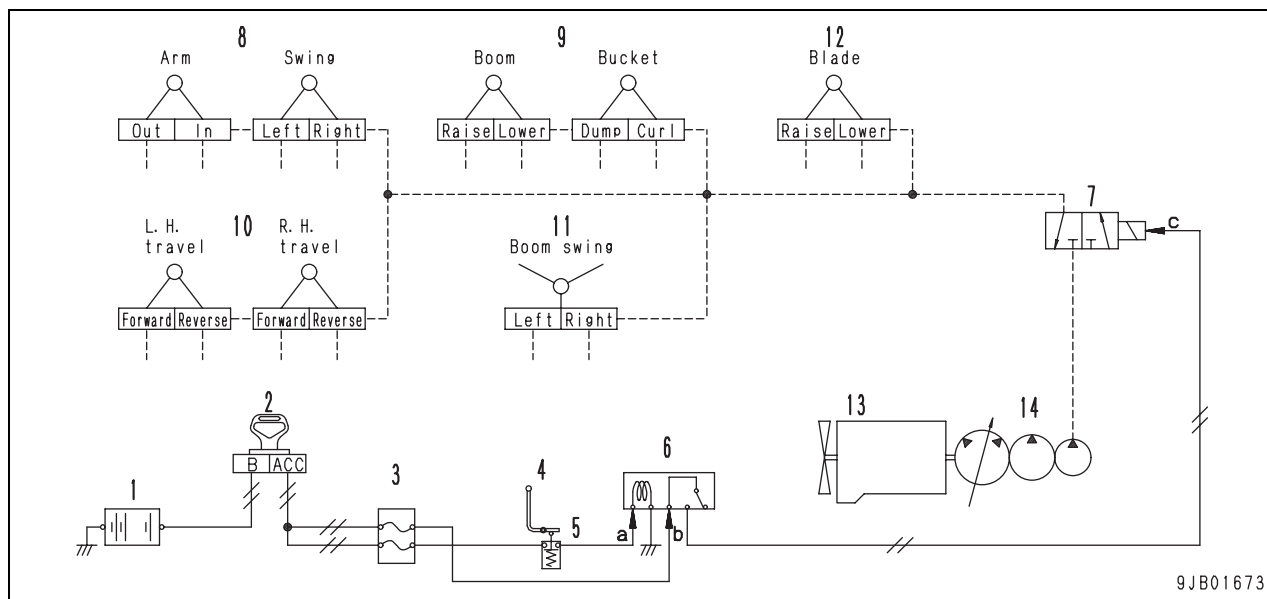
- If the travel speed selector switch of the blade lever is operated, the motor capacity changes, thus the travel speed changes.
- ★ Even while the machine is traveling at the high speed (High), if the load changes largely on a soft ground or on a slope, the travel speed is set to the low speed (Low) automatically. At this time, the 2nd travel speed selector monitor keeps lighting up.



A: 19.8 MPa {202 kg/cm²}

B: 21.3 MPa {217 kg/cm²}

2nd travel speed selector switch		Low speed	High speed
2nd travel speed selector monitor		OFF	ON
2nd travel speed selector solenoid valve		OFF	ON
Motor capacity (cm ³ /rev)		22.1	11.7
Travel speed (km/h)	PC27MR-3	2.6	4.8
	PC30MR-3	2.5	4.6
	PC35MR-3	2.8	4.8
Travel motor swash plate angle		Max.	Min.

PPC lock function**PC27MR-3, PC30MR-3****PC35MR-3**

1. Battery
2. Starting switch
3. Fuse box
4. Lock lever
5. PPC lock switch
6. PPC lock solenoid relay
7. PPC lock solenoid valve
8. Left PPC valve
9. Right PPC valve
10. Travel PPC valve
11. Boom swing PPC valve
12. Blade PPC valve
13. Engine
14. Hydraulic pump
15. Control valve

Input and output signals

- a. PPC lock signal
- b. Solenoid power supply
- c. Solenoid valve drive signal

Function

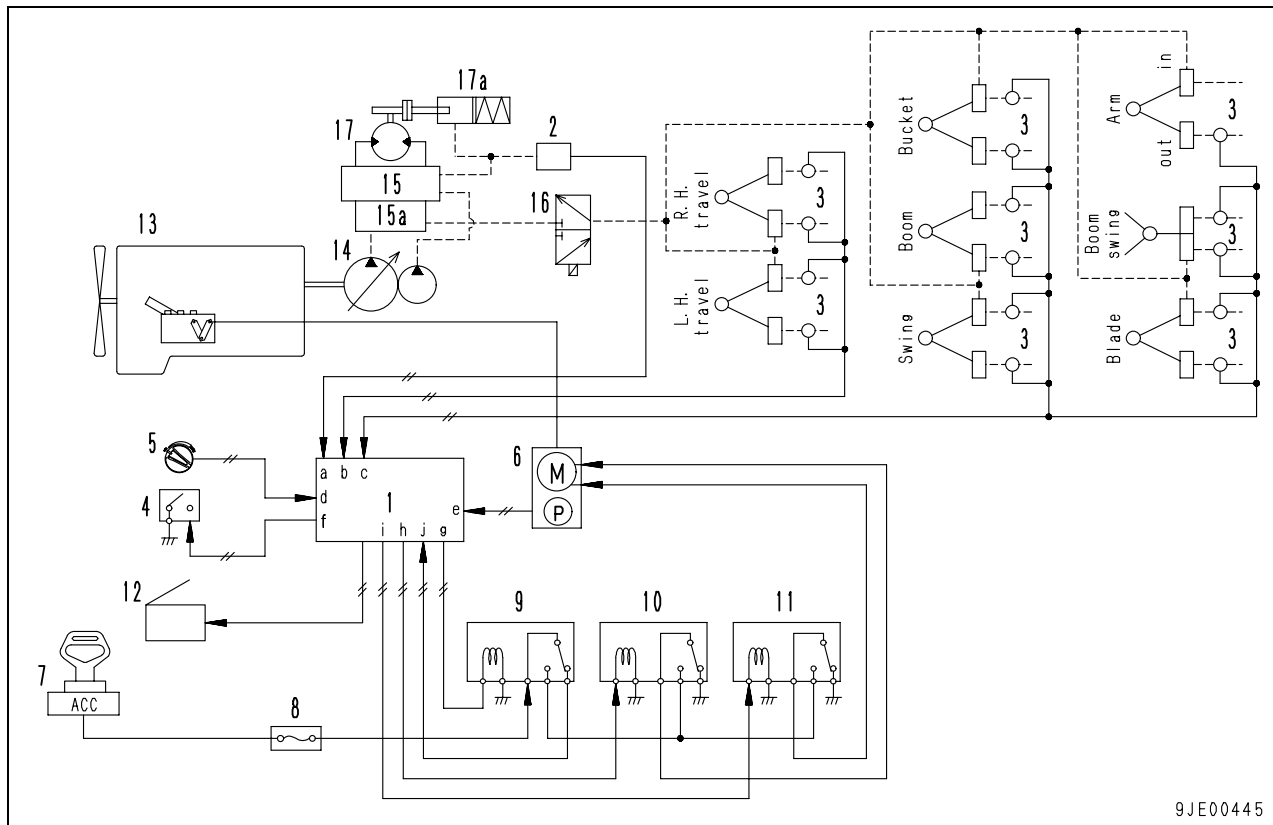
- The PPC lock switch is interlocked with the lock lever. If the lock lever is set in the LOCK position, the PPC lock switch is turned OFF.
- If the PPC lock switch is turned OFF, the current flowing to the PPC lock solenoid valve is shut off. Then, the work equipment and machine unit do not move even if any control lever or pedal is operated.

Auto-deceleration function

General system drawing

(Auto-deceleration specification)

PC27MR-3



- | | |
|---|---|
| 1. Controller (Auto-deceleration) | a. Swing holding brake release sensor signal (Input as operation signal of Swing [Left-Right] and Arm [in] to controller) |
| 2. Oil pressure sensor | b. Travel control lever, operation oil pressure switch signal |
| 3. Oil pressure switch | c. Work equipment control lever, operation oil pressure switch signal |
| 4. Auto-deceleration switch | d. Fuel control dial, potentiometer signal |
| 5. Fuel control dial | e. Fuel control motor, potentiometer signal |
| 6. Fuel control motor | f. Auto-deceleration switch, ON/OFF signal |
| 7. Starting switch | g. Fuel control motor, drive signal |
| 8. Fuse box | h. Fuel control motor, acceleration signal |
| 9. Fuel control motor relay (For driving) | i. Fuel control motor, deceleration signal |
| 10. Fuel control motor relay (For acceleration) | j. Fuel control motor, secondary monitor signal of drive signal |
| 11. Fuel control motor relay (For deceleration) | |
| 12. Travel alarm | |
| 13. Engine | |
| 14. Hydraulic pump | |
| 15. Control valve | |
| 15a. Self-pressure reducing valve | |
| 16. PPC lock solenoid valve | |
| 17. Swing motor | |
| 17a. Swing holding brake | |

Function

- If all the control levers are set in neutral when waiting for a dump truck or a next work, the engine speed is decreased to the control speed automatically to reduce fuel consumption and noise.
- If any lever is operated, the engine speed increases to the speed set with the fuel control dial.

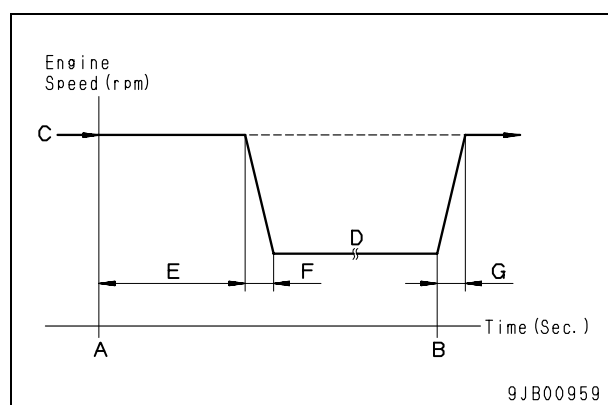
Operation

When all levers are set in neutral

- While the engine is running at a speed above the engine control speed, if all the control levers are kept in neutral for 4 seconds, the engine speed is decreased and kept at the engine control speed until a control lever is operated.

When control lever is operated

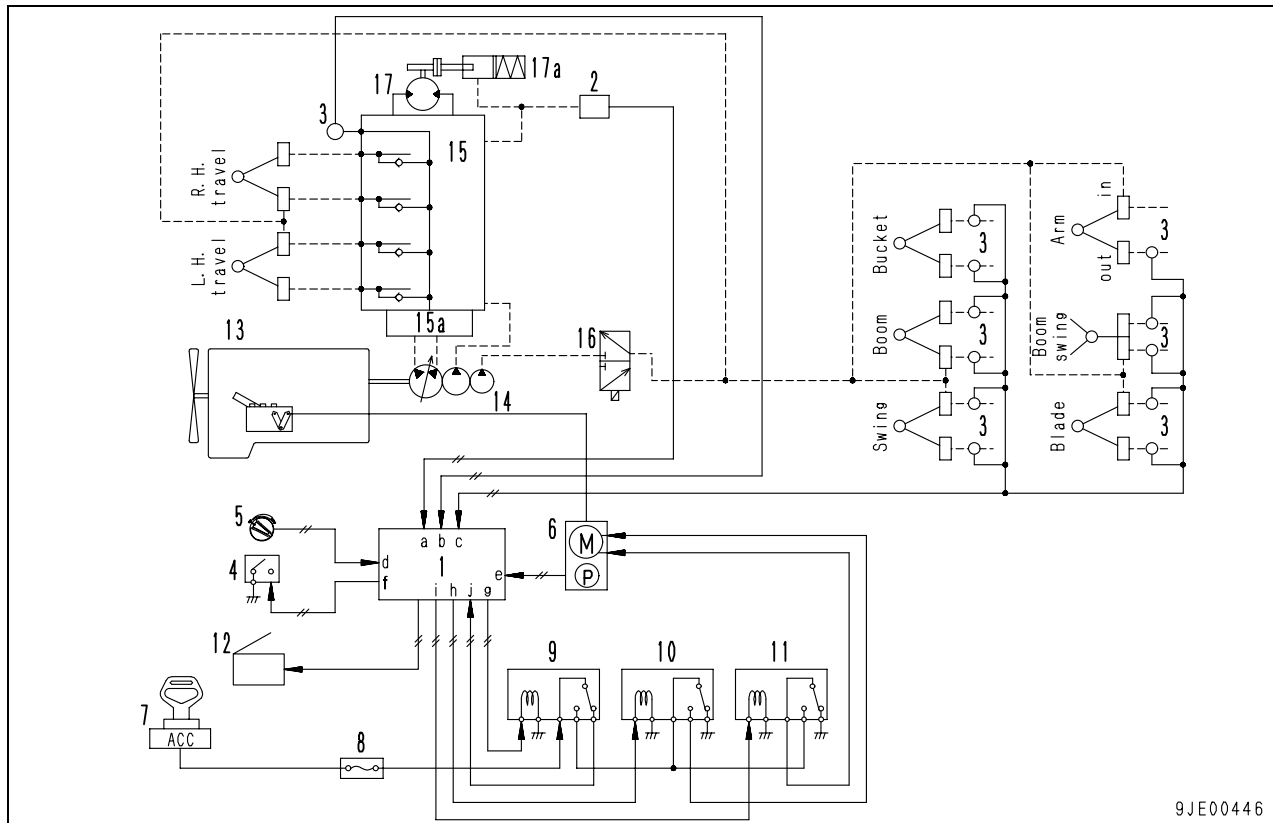
- While the engine speed is kept at the engine control speed, if any control lever is operated, the engine speed increases to the speed set with the fuel control dial.



- A: All work equipment control levers in "neutral"
 B: Work equipment control lever "operated"
 C: Speed set with fuel control dial
 D: Engine control speed
 E: 4 sec
 F: Max. 2 sec
 G: Max. 2 sec

Engine control speed

Model	PC27MR-3
Engine control speed (rpm)	1,560

(Auto-deceleration specification)**PC35MR-3**

9JE00446

- | | |
|---|---|
| 1. Controller (Auto-deceleration) | a. Swing holding brake release sensor signal
(Input as operation signal of Swing [Left-Right]
and Arm [in] to controller) |
| 2. Oil pressure sensor | b. Travel control lever, operation oil pressure
switch signal |
| 3. Oil pressure switch | c. Work equipment control lever, operation oil
pressure switch signal |
| 4. Auto-deceleration switch | d. Fuel control dial, potentiometer signal |
| 5. Fuel control dial | e. Fuel control motor, potentiometer signal |
| 6. Fuel control motor | f. Auto-deceleration switch, ON/OFF signal |
| 7. Starting switch | g. Fuel control motor, drive signal |
| 8. Fuse box | h. Fuel control motor, acceleration signal |
| 9. Fuel control motor relay (For driving) | i. Fuel control motor, deceleration signal |
| 10. Fuel control motor relay (For acceleration) | j. Fuel control motor, secondary monitor signal of
drive signal |
| 11. Fuel control motor relay (For deceleration) | |
| 12. Travel alarm | |
| 13. Engine | |
| 14. Hydraulic pump | |
| 15. Control valve | |
| 15a. Self-pressure reducing valve | |
| 16. PPC lock solenoid valve | |
| 17. Swing motor | |
| 17a. Swing holding brake | |

Function

- If all the control levers are set in neutral when waiting for a dump truck or a next work, the engine speed is decreased to the control speed automatically to reduce fuel consumption and noise.
- If any lever is operated, the engine speed increases to the speed set with the fuel control dial.

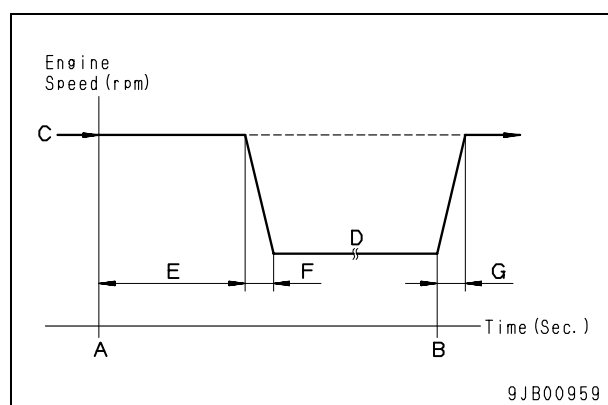
Operation

When all levers are set in neutral

- While the engine is running at a speed above the engine control speed, if all the control levers are kept in neutral for 4 seconds, the engine speed is decreased and kept at the engine control speed until a control lever is operated.

When control lever is operated

- While the engine speed is kept at the engine control speed, if any control lever is operated, the engine speed increases to the speed set with the fuel control dial.



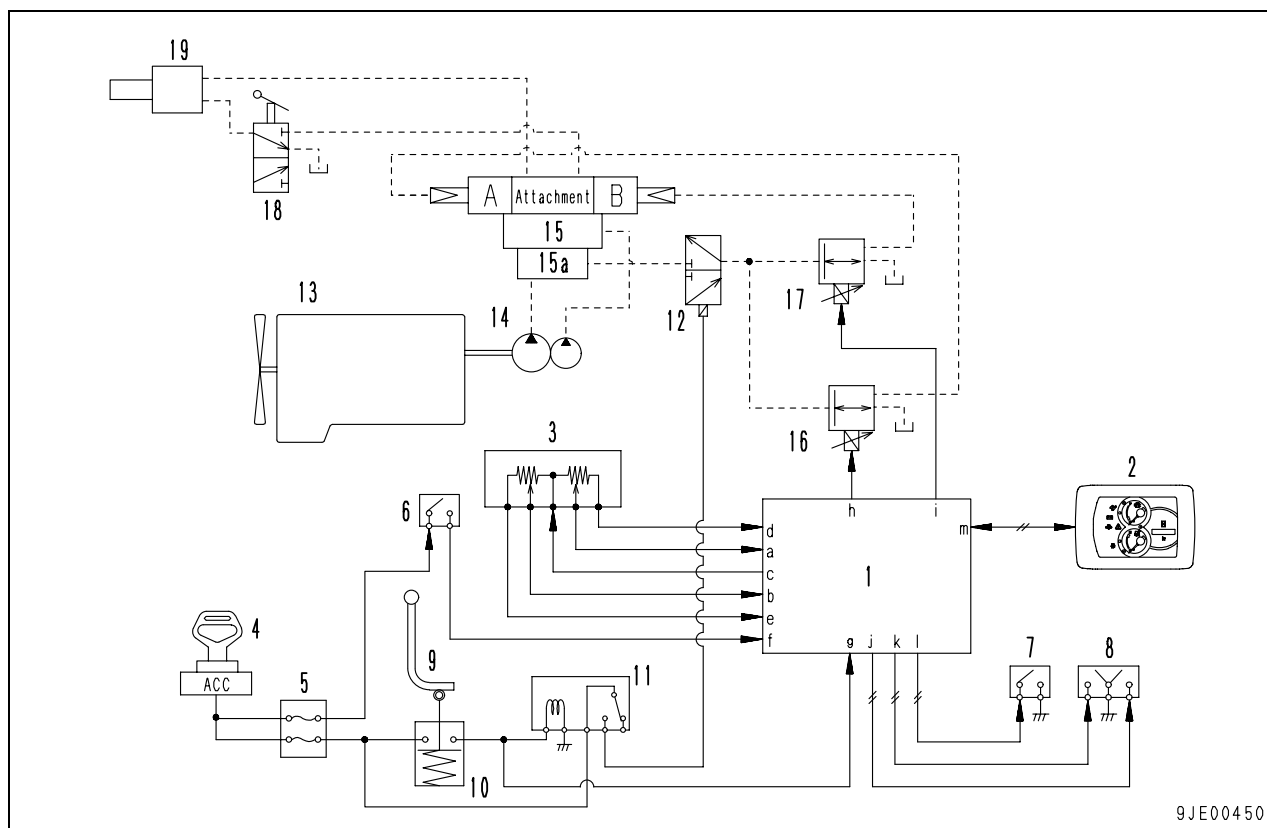
- A: All work equipment control levers in "neutral"
 B: Work equipment control lever "operated"
 C: Speed set with fuel control dial
 D: Engine control speed
 E: 4 sec
 F: Max. 2 sec
 G: Max. 2 sec

Engine control speed

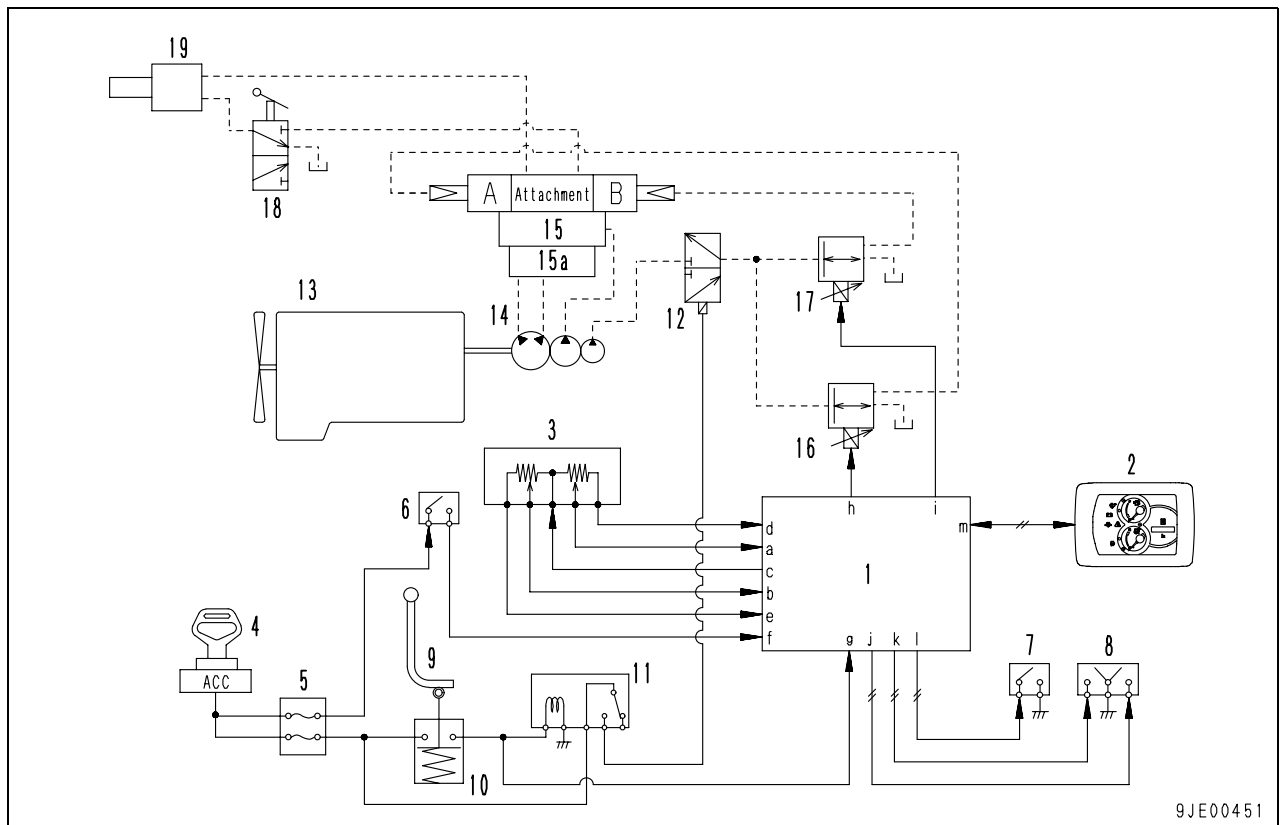
Model	PC35MR-3
Engine control speed (rpm)	1,450

Attachment proportional switch, breaker operation switch, work mode selection, flow control function

PC27MR-3



- | | |
|---|--|
| 1. Controller | a. Attachment proportional switch signal (Main) |
| 2. Machine monitor | b. Attachment proportional switch signal (Sub) |
| 3. Attachment proportional switch | c. 5V potentiometer power supply |
| 4. Starting switch | d. Attachment proportional switch ground (Main) |
| 5. Fuse box | e. Attachment proportional switch ground (Sub) |
| 6. Breaker operation switch | f. Breaker operation switch signal |
| 7. Service switch (Auto-deceleration switch if machine is equipped with auto-deceleration function) | g. PPC lock switch signal |
| 8. Mode changeover switch | h. EPC valve drive signal (Port (A) side of control valve) |
| 9. Lock lever | i. EPC valve drive signal (Port (B) side of control valve) |
| 10. PPC lock switch | j. Mode changeover switch signal (Attachment mode) |
| 11. PPC lock solenoid relay | k. Mode changeover switch signal (Breaker mode) |
| 12. PPC lock solenoid valve | l. Service switch, ON/OFF signal |
| 13. Engine | m. CAN signal |
| 14. Hydraulic pump | |
| 15. Control valve | |
| 15a. Self-pressure reducing valve | |
| 16. EPC valve (Port (A) side of control valve) | |
| 17. EPC valve (Port (B) side of control valve) | |
| 18. Attachment circuit selector valve | |
| 19. Attachment | |

PC35MR-3

9JE00451

- | | |
|---|--|
| 1. Controller | a. Attachment proportional switch signal (Main) |
| 2. Machine monitor | b. Attachment proportional switch signal (Sub) |
| 3. Attachment proportional switch | c. 5V potentiometer power supply |
| 4. Starting switch | d. Attachment proportional switch ground (Main) |
| 5. Fuse box | e. Attachment proportional switch ground (Sub) |
| 6. Breaker operation switch | f. Breaker operation switch signal |
| 7. Service switch (Auto-deceleration switch if machine is equipped with auto-deceleration function) | g. PPC lock switch signal |
| 8. Mode changeover switch | h. EPC valve drive signal (Port (A) side of control valve) |
| 9. Lock lever | i. EPC valve drive signal (Port (B) side of control valve) |
| 10. PPC lock switch | j. Mode changeover switch signal (Attachment mode) |
| 11. PPC lock solenoid relay | k. Mode changeover switch signal (Breaker mode) |
| 12. PPC lock solenoid valve | l. Service switch, ON/OFF signal |
| 13. Engine | m. CAN signal |
| 14. Hydraulic pump | |
| 15. Control valve | |
| 15a. Self-pressure reducing valve | |
| 16. EPC valve (Port (A) side of control valve) | |
| 17. EPC valve (Port (B) side of control valve) | |
| 18. Attachment circuit selector valve | |
| 19. Attachment | |

Function

Attachment proportional switch function

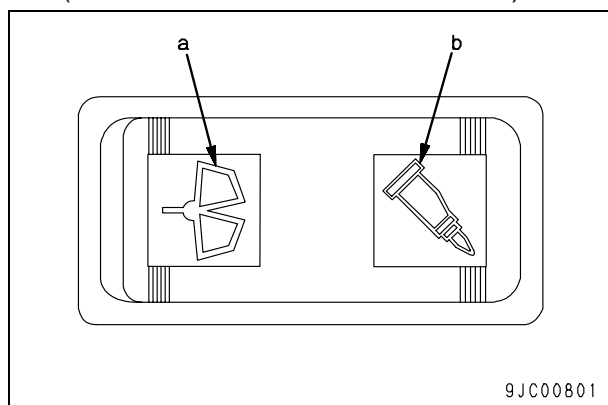
- Hydraulic oil is supplied to the attachment piping according to the operation distance of the attachment proportional switch to operate a 2-way attachment such as the crusher.
- This function operates only when the work mode is set to the attachment mode.
 - Right switch: Right attachment piping of work equipment
 - Left switch: Left attachment piping of work equipment

Breaker operation switch function

- If the breaker operation switch is depressed once, certain quantity of hydraulic oil is supplied to the attachment piping to operate a 1-way attachment such as the breaker.
- This function operates only when the work mode is set to the breaker mode.
 - Breaker operation switch: Left attachment piping of work equipment

Work mode changeover function

- A proper work mode is selected with the work mode changeover switch for each type of work.
(Prevention of overwork of attachment)



Symbol at work mode changeover switch section	Work mode
Lights up (a)	Attachment mode : Attachment proportional switch becomes effective
Lights up (b)	Breaker mode : Breaker operation switch becomes effective
Both are off	Normal mode : Attachment proportional switch and breaker operation switch are ineffective

- ★ If the lighting side of the work mode changeover switch is depressed again, both sides go off (The machine is set in the normal mode).

Flow control function

The flow rates of the attachment mode and breaker mode are set respectively with the service switch (or auto-deceleration switch if the machine is equipped with the auto-deceleration function) and mode changeover switch.

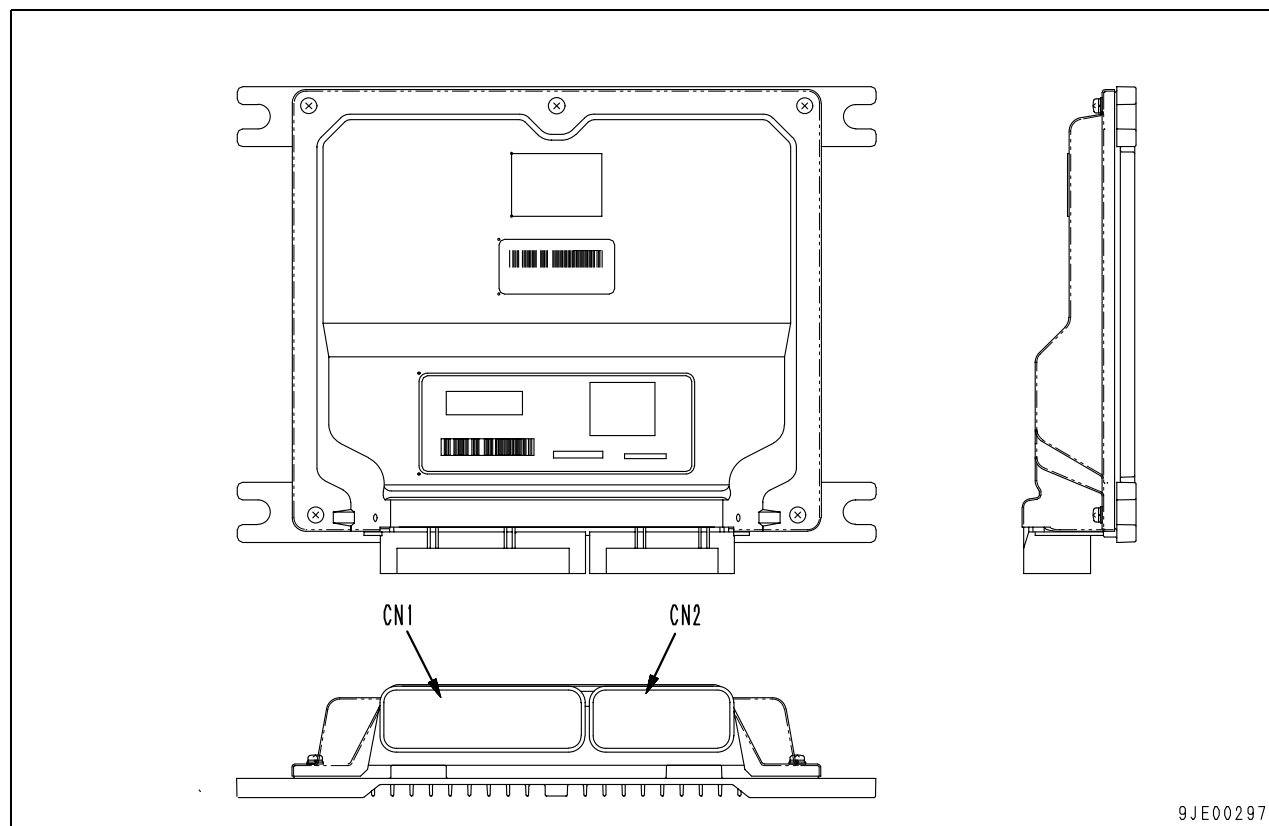
In the attachment mode, the oil flow to the attachment when the attachment proportional switch is leaned to the right or left stroke end is controlled.

In the breaker mode, the oil flow to the breaker when the breaker operation switch is depressed is controlled.

Controller

(Attachment switch, auto-deceleration specification)

PC27MR-3, PC35MR-3



Input and output signals**TYCO-1241434-81P[CN-G1]****CN1**

Pin No.	Signal name	Input/ Output signal
1	Unswitched power supply	Output
2	Unswitched power supply return	Input
3	NC (*)	—
4	Unswitched power supply	Output
5	Unswitched power supply return	Input
6	NC (*)	Input
7	CAN_H	—
8	Potentiometer power supply (5V)	Output
9	Potentiometer power supply (5V)	Output
10	NC (*)	Input
11	Swing lock reset PPC pressure sensor, travel PPC pressure sensor	Input
12	Governor stroke sensor	Input
13	Analog signal ground	Input
14	Terminal resistance	—
15	NC (*)	—
16	NC (*)	—
17	Starting switch ACC	Input
18	NC (*)	—
19	Digital signal ground	Input
20	Digital signal ground	Input
21	Auto-deceleration ON/OFF switch	Input
22	Height limit clear switch	Input
23	Counterweight selection signal	Input
24	External start signal	Input
25	NC (*)	Input
26	CAN_L	—
27	NC (*)	—
28	NC (*)	—
29	Boom angle sensor	Input
30	Boom bottom pressure sensor	Input
31	NC (*)	Input
32	Analog signal ground	Input
33	Terminal resistance	—
34	NC (*)	—
35	NC (*)	—
36	NC (*)	—
37	NC (*)	—
38	Digital signal ground	Input
39	Breaker mode switch	Input
40	ATT mode switch	Input

*: Never connect to NC or malfunctions or failures will occur.

Pin No.	Signal name	Input/ Output signal
41	Motor power supply relay secondary monitor signal	Input
42	Height set switch	Input
43	Work equipment PPC pressure switch	Input
44	Pulse input ground	Input
45	NC (*)	—
46	Analog signal ground	Input
47	Analog signal ground	Input
48	Arm angle sensor	Input
49	Right ATT switch (main), boom raise PPC pressure sensor	Input
50	Analog input	Input
51	Analog signal ground	Input
52	Analog signal ground	Input
53	NC (*)	—
54	NC (*)	—
55	NC (*)	—
56	NC (*)	—
57	NC (*)	—
58	NC (*)	—
59	Boom swing neutral signal	Input
60	Auto-escape ON switch	Input
61	Breaker switch	Input
62	Starting switch ACC	Input
63	NC (*)	—
64	NC (*)	—
65	Analog signal ground	Input
66	Analog signal ground	Input
67	Right ATT switch (sub), offset angle sensor	Input
68	Fuel control dial	Input
69	NC (*)	Input
70	Analog signal ground	Input
71	Pulse input ground	Input
72	NC (*)	—
73	NC (*)	—
74	NC (*)	—
75	NC (*)	—
76	Digital signal ground	Input
77	NC (*)	Input
78	Travel PPC pressure switch	Input
79	NC (*)	Input
80	Emergency reset switch	Input
81	NC (*)	—

*: Never connect to NC or malfunctions or failures will occur.

CN2

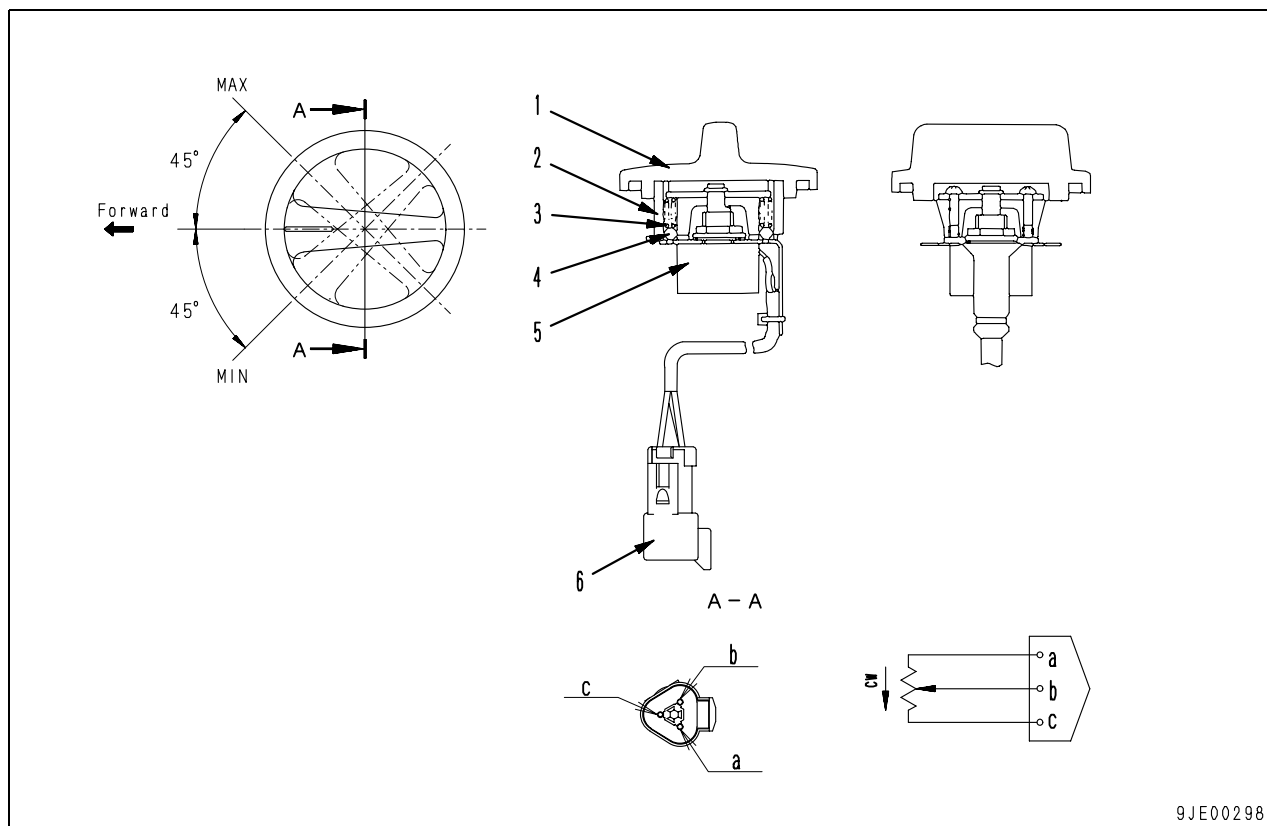
Pin No.	Signal name	Input/ Output signal
82	NC (*)	—
83	ATT mode LED	Output
84	Boom swing neutral sensor power supply, Offset left stop solenoid	Output
85	Motor power supply relay	Output
86	Travel alarm	Output
87	NC (*)	—
88	NC (*)	—
89	NC (*)	—
90	NC (*)	—
91	Breaker mode LED	Output
92	Arm crane rotary lamp drive relay	Output
93	2nd travel speed selector relay, solenoid	Output
94	Bucket dump stop solenoid	Output
95	NC (*)	—
96	NC (*)	—
97	NC (*)	—
98	Height limit LED	Output
99	NC (*)	—
100	Height limit rotary lamp drive relay	Output
101	Motor drive relay (—)	Output
102	Boom raise stop EPC	Output
103	ATT (Port B) EPC	Output
104	NC (*)	—
105	NC (*)	—
106	Auto-deceleration LED	Output
107	PPC lock solenoid	Output
108	NC (*)	—
109	Motor drive relay (+)	Output
110	Arm in stop EPC	Output
111	ATT (Port A) EPC, Arm dump EPC	Output
112	NC (*)	—
113	NC (*)	—
114	Solenoid load return	Input
115	Solenoid load return	Input
116	Battery relay secondary power supply	Input
117	Solenoid load return	Input
118	Battery relay secondary power supply	Input
119	NC (*)	—
120	Solenoid load return	Input
121	Battery relay secondary power supply	Input

*: Never connect to NC or malfunctions or failures will occur.

Fuel control dial

(Attachment switch, auto-deceleration specification)

PC27MR-3, PC35MR-3

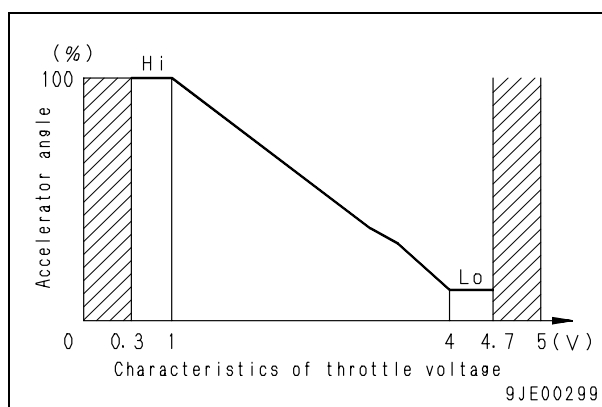


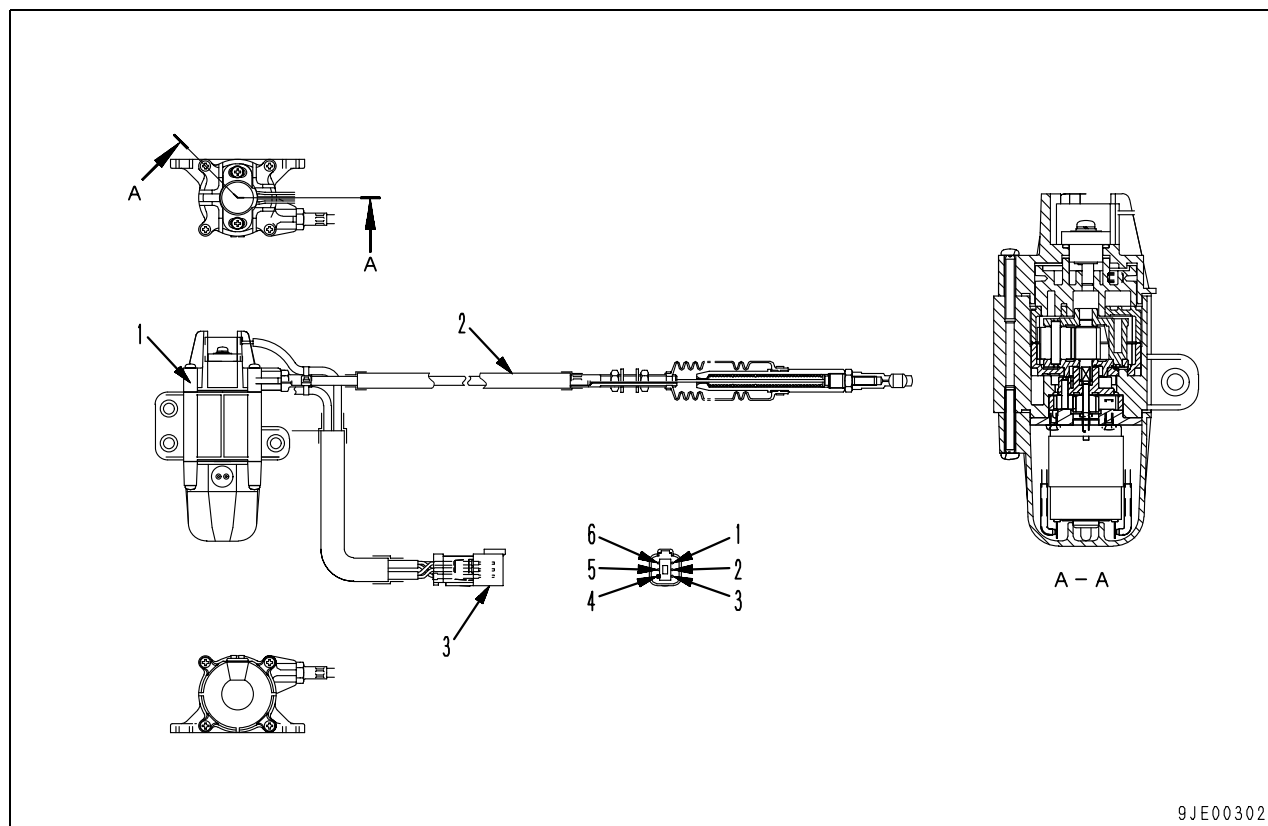
9JE00298

1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector

Function

- The fuel control dial is installed to the right console box. Potentiometer (5) is installed under knob (1). If knob (1) is rotated, the shaft of potentiometer (5) is rotated.
- The resistance of the variable resistor in potentiometer (5) changes and a throttle signal is sent to the controller.
- The hatched areas in the graph is the abnormality detection areas. In those areas, the engine speed is set to high idle.



Fuel control motor**(Attachment switch, auto-deceleration specification)****PC27MR-3, PC35MR-3**

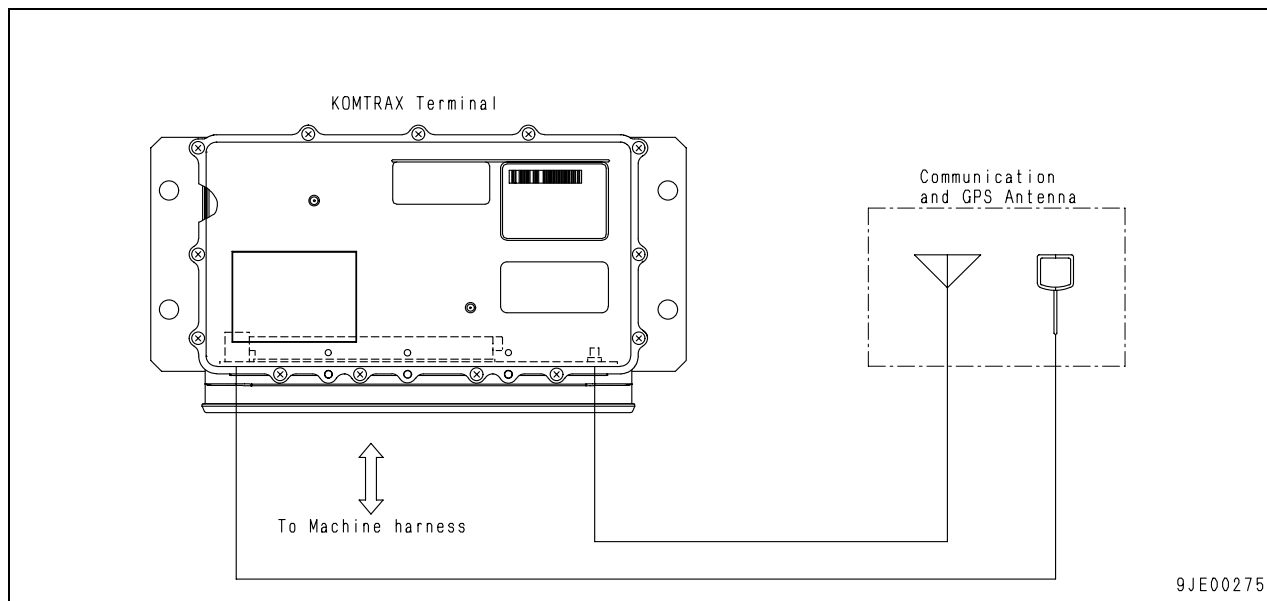
1. Motor assembly
2. Cable
3. Connector

Input and output signals

DT04-06P [CN-E1]

Pin No.	Wire		Signal name
	Color	Type	
1	Green	AVX 0.75	Potentiometer VCC
2	Yellow	AVX 0.75	Potentiometer OUT
3	Black	AVX 0.75	Potentiometer GND
4	—	—	Dummy plug
5	Pink	AVX 0.75	Motor (+)
6	White	AVX 0.75	Motor (—)

KOMTRAX system

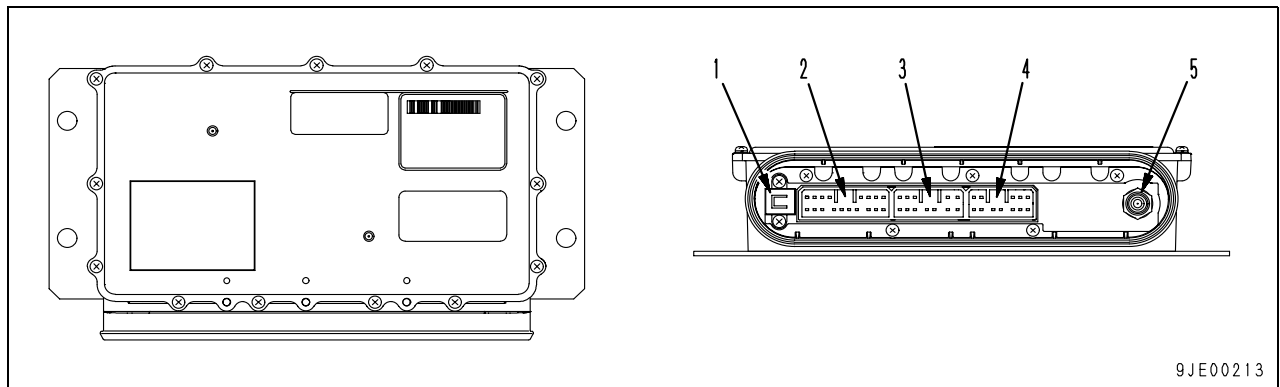


- The KOMTRAX terminal transmits various kinds of machine information wirelessly. The KOMTRAX operator can refer to the information at the office to provide various kinds of services for customers.
- ★ To provide the services, a separate arrangement for setting up the KOMTRAX terminal is required.

Information transmittable from the KOMTRAX terminal includes the following.

1. Operating information
2. Service meter
3. Position information
4. Fuel level

KOMTRAX terminal



1. GPS antenna connection
2. Connector (A)
3. Connector (B)
4. Connector (C)
5. Communication antenna connection

Outline

- The KOMTRAX terminal can obtain various kinds of information from network signals or input signals in the machine and transmit them through the wireless communication antenna. It has a CPU (Central Processing Unit) in it and also has wireless communication function and GPS (Global Positioning System) function.
- This terminal has LED lamps and 7-segment indicator lamps used for inspection and troubleshooting on its unit.

Input and output signals

174480-1 AMP (18 + 12 + 12 pins)

Pin No.			Signal name			I/O signal					
A	1	PWR_OUT_5V	O	B	1	NC		C	1	GND	
	2	GND			2	NC			2	GND	
	3	COMM_SNET	I/O		3	COMM_232C_DTR_1	O		3	PWR_CTR_KEY	I
	4	GND			4	COMM_232C_DCD_1	I		4	AIS_V_0	I
	5	DIS_H_4	I		5	COMM_232C_DSR_1	I		5	AIS_V_1	I
	6	DIS_H_3	I		6	GND			6	PWR_IN_BATT	I
	7	DIS_L_2	I		7	DIS_FWE_SW	I		7	PWR_IN_BATT	I
	8	DIS_L_1	I		8	PWR_CTR_EXT	I/O		8	DOS_L_0	O
	9	COMM_CAN_SH_0			9	COMM_232C_TXD1/ORB_TXD	O		9	DIS_L_CHK0	I
	10	COMM_CAN_H_0	I/O		10	COMM_232C_RXD1/ORB_RXD	I		10	DIS_L_CHK1	I
	11	COMM_CAN_L_0	I/O		11	COMM_232C_RTS_1	O		11	DIS_H_0	I
	12	DIS_H_7	I		12	COMM_232C_CTS_1	I		12	AIS_V_2	I
	13	DIS_H_6	I								
	14	DIS_H_5	I								
	15	GND									
	16	AIS_V_3	I								
	17	AIS_V_4	I								
	18	AIS_V_5	I								

Component parts of system

PPC lock solenoid valve

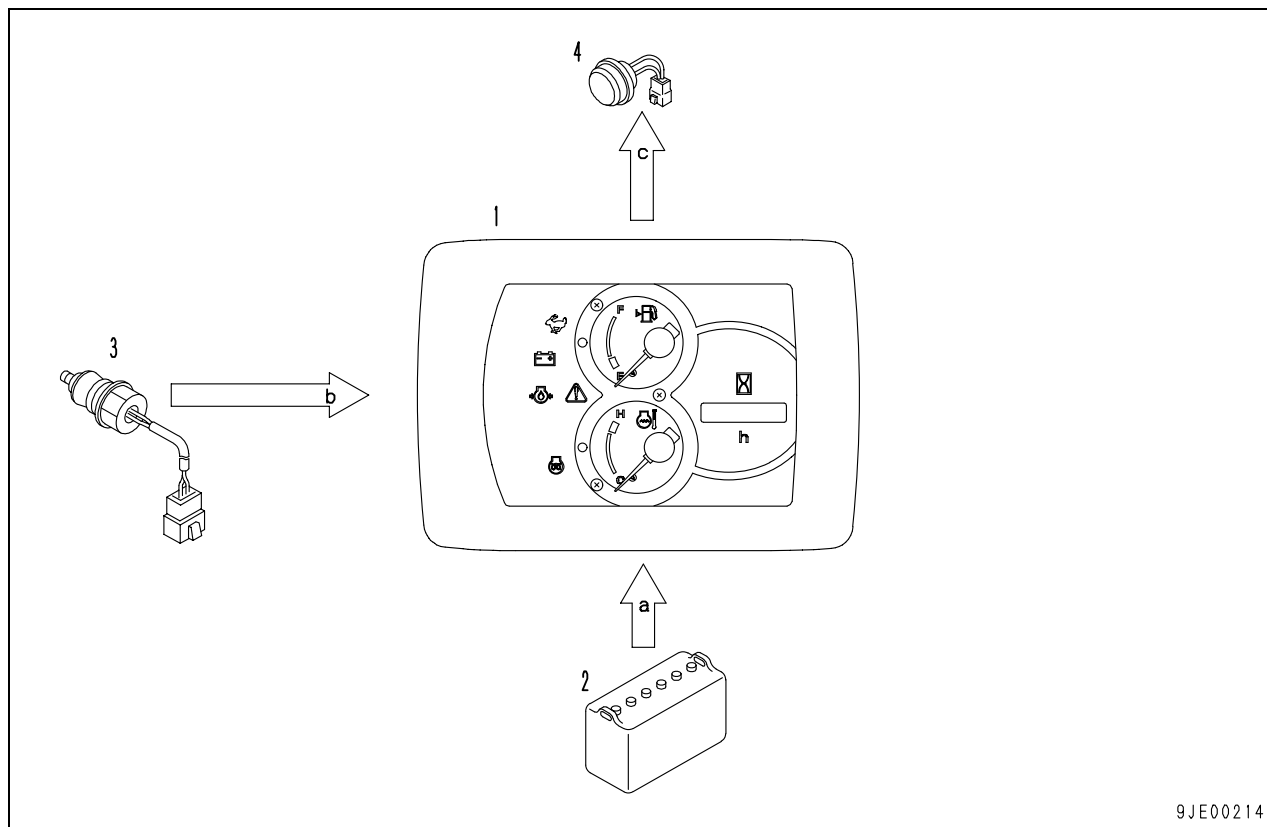
2nd travel speed selector solenoid valve

★ See "Solenoid valve".

Machine monitor

★ See "Monitor system".

Monitor system



1. Machine monitor
2. Battery
3. Each sensor
4. Alarm buzzer

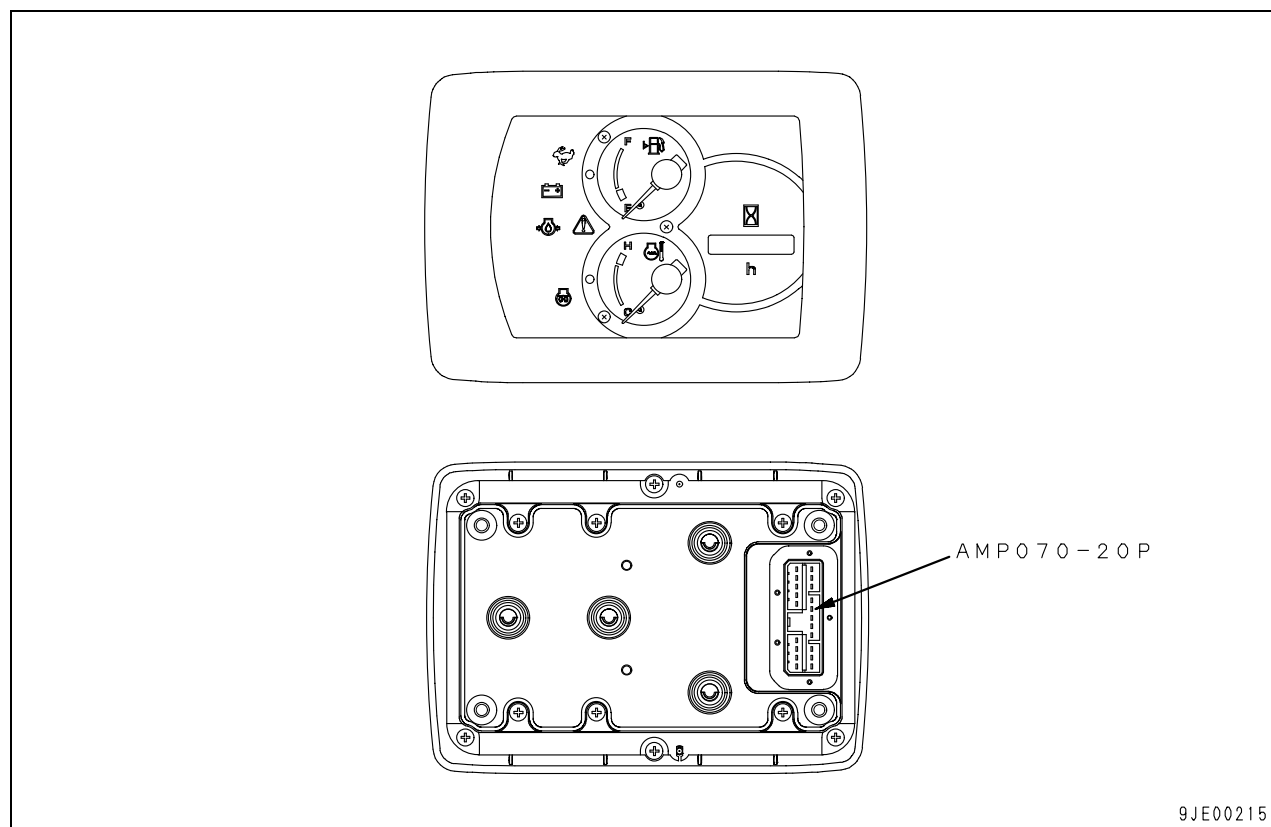
Input and output signals

- a. Power supply
- b. Sensor signal
- c. Alarm buzzer signal

Outline

- The machine monitor system uses the network circuit between the controllers and sensor installed to all parts of the machine to observe the condition of the machine. It processes this information, and display it on a panel to inform the operator of condition of the machine.

Machine monitor



Outline

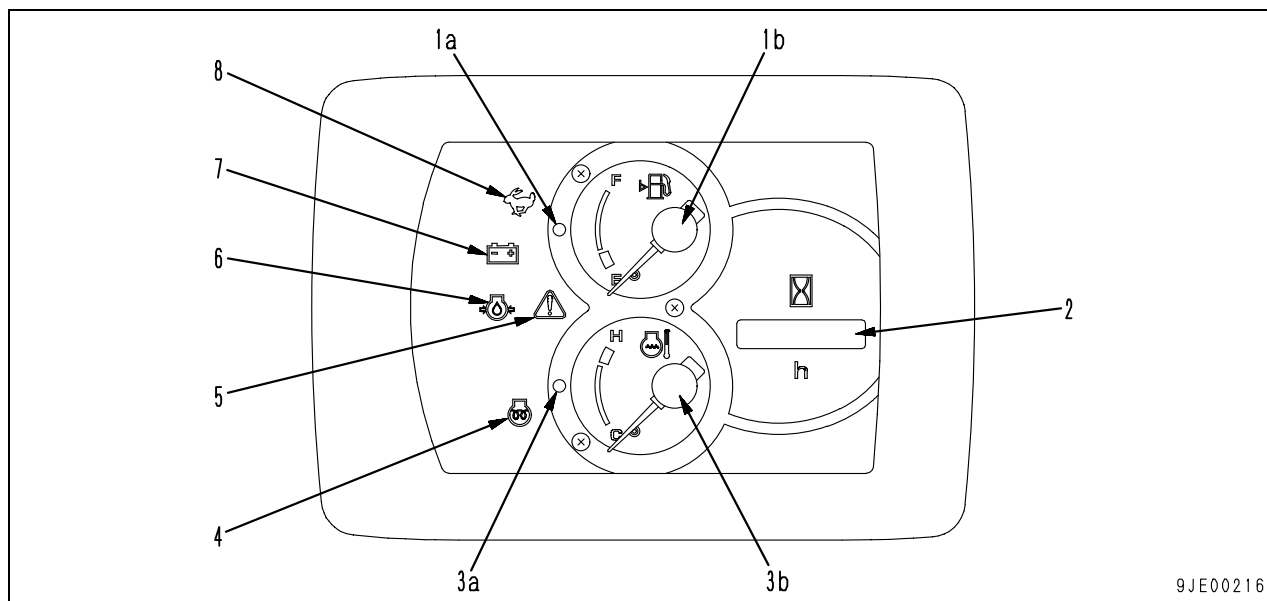
- The machine monitor has the monitor display function, gauge display function and service meter function.
- The machine monitor has a CPU (Central Processing Unit) in it to process, display and output information.
- If there is a trouble in the machine monitor unit, the monitor does not display normally.

Input and output signals

AMP070-20P [CN-F15]

Pin No.	Signal name	Input/Output signal
1	GND	Input
2	NC	Input
3	NC	Input
4	Wake up switch	Input
5	CAN (-)	Input/Output
6	Speed increase	Input
7	Engine oil pressure switch	Input
8	Preheating switch	Input
9	Key input	Input
10	Sensor GND	Input

Pin No.	Signal name	Input/Output signal
11	Buzzer output	Output
12	Working lamp switch	Input
13	Fuel level sensor	Input
14	CAN (+)	Input/Output
15	Speed increase solenoid relay output	Output
16	Engine coolant temperature sensor	Input
17	Battery charge level	Input
18	NC	Input
91	ACC	Input
20	Unswitched power supply	Input

Operation

9JE00216

Gauge and monitor display unit

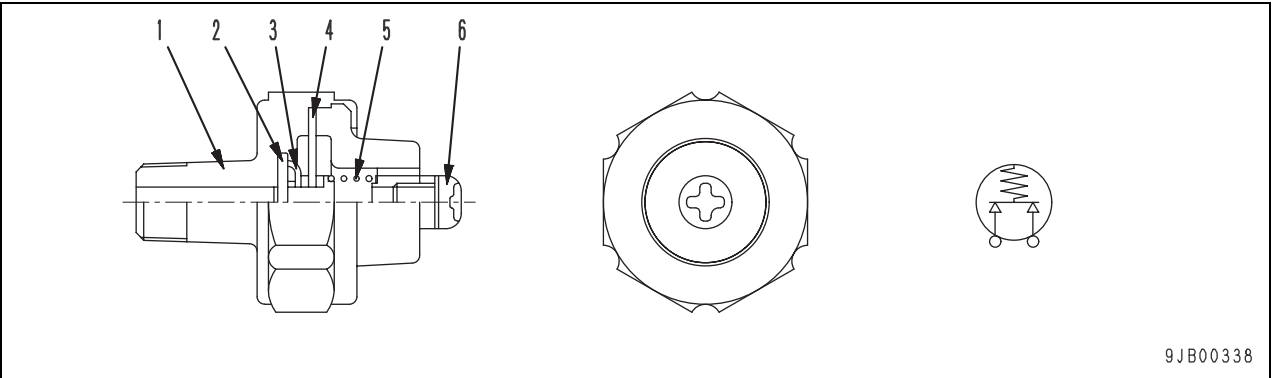
No.	Type of display	Display item	Display range	Display method	Display color	Light source element
1a	Pilot	Fuel level	When below red range	When normal: OFF When below red range: Flashing	Red	LCD
1b	Gauge		Empty – Full	Indication with pointer	White	LED
2	Service meter		0 – 99999.9 h	Operation during run of engine	Display of clock time	LED
3a	Gauge	Coolant temperature	55 – 135°C	Indication with pointer	White	
3b	Pilot		When coolant temperature is abnormal	When normal: OFF When above 110°C: Flashing	Red	
4	Caution	Preheating	During preheating	During operation: Flashing (18 sec)	Green	
5	Caution	Electrical system warning	When system is abnormal	When abnormal: Lighting or flashing	Red	
6	Caution	Engine oil pressure	Below specified pressure	When abnormal: Flashing		
7	Caution	Battery charge level	When charge is defective	When abnormal: Flashing		
8	Pilot	Travel speed increase	When travel speed is increased	When speed is increased: Lighting	Orange	

Sensors

- The signal from each sensor is input to the panel directly.
- The sensors are classified into contact type and resistance type.
- Either side of a sensor of contact type is always connected to the chassis ground.

Category of display	Name of sensor	Type of sensor	When normal	When abnormal
Caution	Engine oil pressure	Contact	OFF (Open)	ON (Closed)
Gauge	Coolant temperature	Resistance	—	—
	Fuel level	Resistance	—	—

Engine oil pressure sensor



1. Plug

2. Contact ring

3. Contact
4. Diaphragm

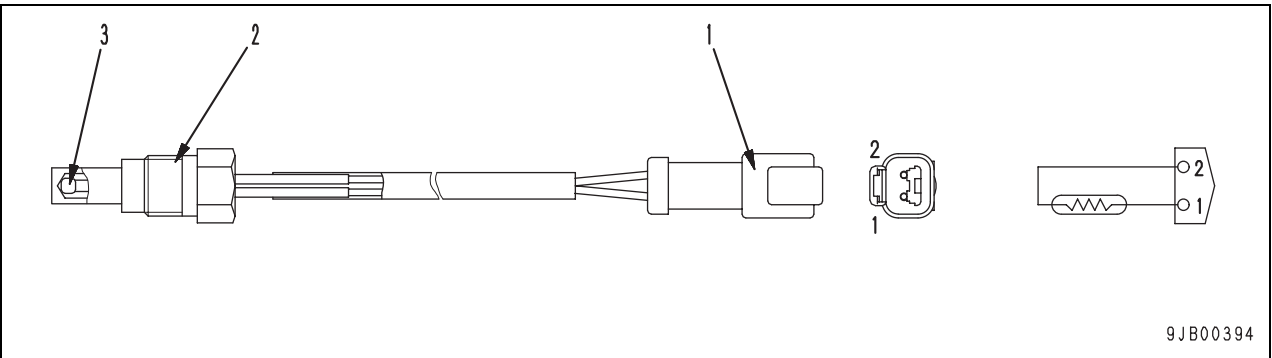
5. Spring

6. Terminal

Function

- The engine oil pressure sensor is installed to the engine cylinder block and its diaphragm senses oil pressure. If the oil pressure lowers below the set level, the switch is turned ON.

Coolant temperature sensor



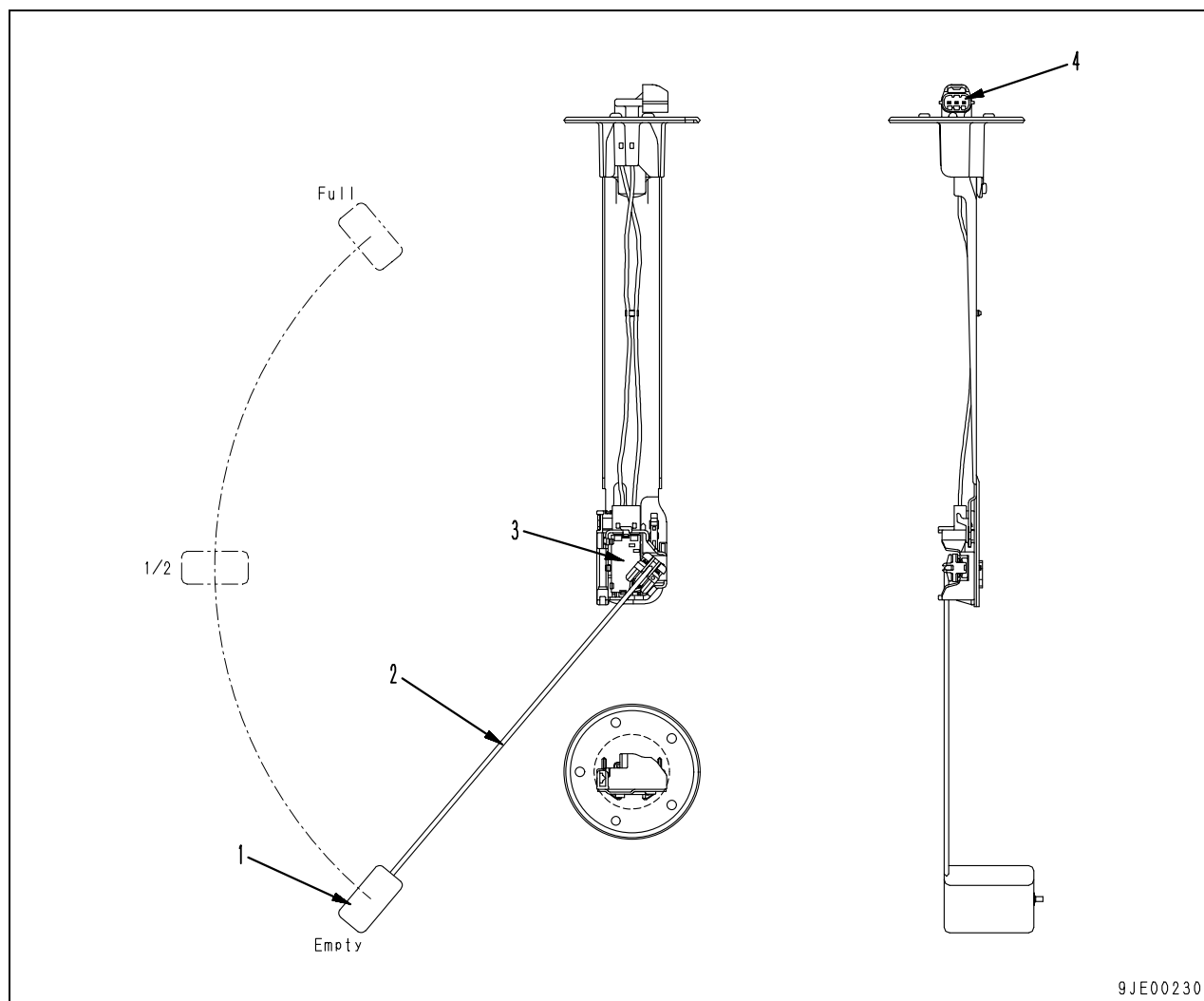
1. Connector

2. Plug
3. Thermistor

Function

- The coolant temperature sensor is installed to the engine cylinder block. It senses changes of temperature as changes of resistance of the thermistor in it, and then generates signals according to the measured temperature.

Fuel level sensor

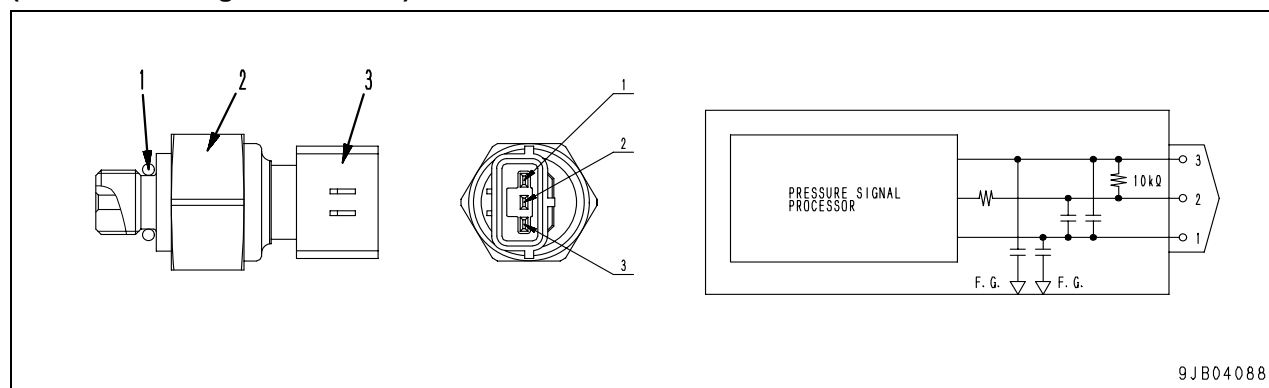


1. Float
2. Arm
3. Variable resistor
4. Connector

Function

- The fuel level sensor is installed to the top of the fuel tank and its float moves up and down according to the fuel level in the tank. The movement of the float operates the variable resistor through the arm, and then signals are generated according to the change of the resistance.

PPC pressure sensor (Travel and swing brake cancel)

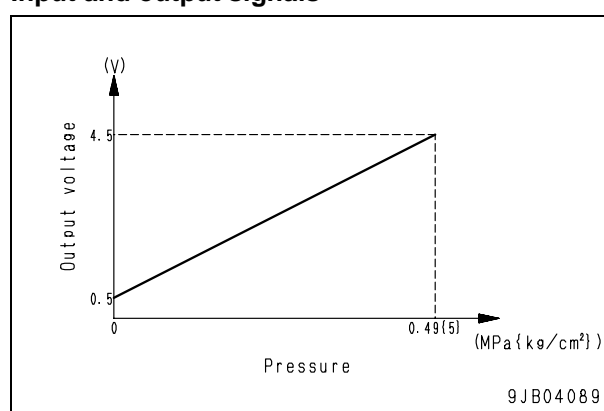


1. O-ring
2. Sensor
3. Connector

Function

- The PPC pressure sensor is installed to the control valve joint of the pilot circuit. It detects pilot pressure and outputs a variable voltage.

Input and output signals



PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04078-01

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

20 Standard value table

100 Standard service value table

Standard service value table for engine related parts	2
Standard service value table for chassis related parts	4

Standard service value table for engine related parts**Applicable model: PC27MR-3**

Applicable model			PC27MR-3	
Engine			3D82AE-6	
Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,780 ± 50	—
	Low idle		1,325 ± 50	—
	Rated speed		2,600	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 25	35
	At high idle		—	—
Valve clearance (Normal temperature)	Intake valve	mm	0.15 – 0.25	—
	Exhaust valve		0.15 – 0.25	—
Compression pressure	Oil temperature: 40 – 60°C Engine speed: 250 rpm	MPa {kg/cm ² }	3.06 – 3.26 {30 – 32}	2.35 – 2.55 {24 – 26}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH ₂ O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm ² }	0.39 – 0.54 {4.0 – 5.5}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.06 {Min. 0.6}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	°C	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	15.5	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	7 – 10	—

Applicable model: PC30MR-3, PC35MR-3

Applicable model			PC30MR-3 PC35MR-3	
Engine			3D88E-6	
Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Engine speed	High idle	rpm	2,550 ± 50	—
	Low idle		1,250 ± 50	—
	Rated speed		2,400	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 25	35
	At high idle		—	—
Valve clearance (Normal temperature)	Intake valve	mm	0.15 – 0.25	—
	Exhaust valve		0.15 – 0.25	—
Compression pressure	Oil temperature: 40 – 60°C Engine speed: 250rpm	MPa {kg/cm ² }	3.33 – 3.53 {34 – 36}	2.65 – 2.85 {27 – 29}
Blow-by pressure	(Coolant temperature: operating range) At high idle	kPa {mmH ₂ O}	— {—}	— {—}
Oil pressure (SAE30W)	(Coolant temperature: operating range) At high idle	MPa {kg/cm ² }	0.39 – 0.54 {4.0 – 5.5}	Min. 0.2 {Min. 2.0}
	At low idle		Min. 0.06 {Min. 0.6}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	°C	Max. 120	Max. 120
Fuel injection timing	Before Top Dead Center	°(degree)	14	—
Alternator belt tension	Deflection when pressed with finger force of approx. 98 N{10 kg}	mm	7 – 10	—

Standard service value table for chassis related parts

Applicable model: PC27MR-3

Machine model				PC27MR-3		
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value	
Engine speed	Speed when 1 pump is relieved	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CEngine oil pressure: Within operating rangeEngine coolant temperature: Within operating range	rpm	Min. 2,300	Min. 2,300	
	Speed when 2 pumps are relieved	<ul style="list-style-type: none">Relief of 1 pump: Relieve bucket circuit.Relief of 2 pumps: Relieve bucket and swing circuits.		Min. 2,100	Min. 2,100	
Stroke of control valve spool	Boom control valve	★ For details, see Fig. A at the end of this section.	mm	$\ell = 30$ $a = 6$ $b = 6$	$\ell = 30$ $a = 6$ $b = 6$	
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	<ul style="list-style-type: none">Stop engine.Measure at center of lever grip.Measure at pedal tip.Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	85 ± 10	85 ± 10
	Arm control lever		N → IN, OUT		85 ± 10	85 ± 10
	Bucket control lever		N → CURL, DUMP		85 ± 10	85 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		85 ± 10	85 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 20	160 ± 20
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 5	Max. 5

Machine model				PC27MR-3		
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value	
Operating effort of control levers and pedals	Boom control lever	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CInstall push-pull scale to center of lever grip or pedal tip to measure.Read max. value to stroke end.	N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Arm control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Bucket control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Swing control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Boom swing control pedal			78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}	
	Blade control lever			29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}	
	Travel control lever			19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}	
	Fuel control lever			Idle → Full throttle	29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
		Full throttle → Idle		29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}	
Oil pressure	Unload pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CSet all levers in neutral.Run engine at full throttle.Measure pump outlet pressure.	MPa {kg/cm²}	3.9 ^{+0.98} ₀ {39.6 ⁺¹⁰ ₀ }	3.9 ^{+0.98} ₀ {39.6 ⁺¹⁰ ₀ }	
	Boom relief pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle and measure relief pressure (Relieve only circuit to be measured).Measure pump outlet pressure.		24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	
	Arm relief pressure			24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	
	Bucket relief pressure			24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	
	Swing relief pressure			18.1 ± 0.98 {185 ± 10}	18.1 ± 0.98 {185 ± 10}	
	Boom swing relief pressure			24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	
	Blade relief pressure			Raise	20.6 ± 0.98 {210 ± 10}	20.6 ± 0.98 {210 ± 10}
				Lower	20.6 ± 0.98 {210 ± 10}	20.6 ± 0.98 {210 ± 10}
	Travel relief pressure			24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	24.5 ^{+0.98} _{-0.49} {250 ⁺¹⁰ ₋₅ }	
	Control circuit oil pressure (Oil pressure lowered by self pressure)	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Measure circuit oil pressure when all control levers are in neutral.Measure pump outlet pressure		2.94 ^{+0.49} _{-0.1} {30 ⁺⁵ ₋₁ }	2.94 ^{+0.49} _{-0.1} {30 ⁺⁵ ₋₁ }	

Machine model				PC27MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Pump outlet pressure – LS pressure	When all levers are in neutral	MPa {kg/cm ² }	$3.9 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {39.6 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }	$3.9 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {39.6 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }
			While bucket is curled with no load (full throttle)		1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}
Swing	Overrun of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CStop after swinging 1 turn and measure shifting distance of swing circle.Value in () is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to pass 90° and 180° points after starting swinging.	90°	sec.	2.1 ± 0.3	2.8
			180°		—	—
	Time required for swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to swing 5 turns after swinging 1 turn.			32 ± 3	37
	Hydraulic drift of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. C at end of this section.Max. reachStop engine.Hydraulic oil temperature: 45 – 55°CFill bucket with rated load or dirt and sand. (Rated load: 1,422 N {145 kg})Stop machine on slope of 15° and set its upper structure at 45° upward.Make match marks on swing circle outer race and track frame.Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CRelieve swing circuit and measure leakage in 1 minute.		cc/min.	—	—

Machine model				PC27MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Travel speed	<ul style="list-style-type: none">★ For measuring posture, see Fig. D at end of this section.• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• After approach run of at least 10 m on flat ground, measure time required to travel 20 m.• (): Machine with steel shoe specification	Low speed	sec.	27.7 ± 2 (26.9 ± 2)	27.7 ± 4 (26.9 ± 4)
			High speed		15.7 ± 2 (15.3 ± 2)	15.7 ± 4 (15.3 ± 4)
	Travel deviation	<ul style="list-style-type: none">★ For measuring posture, see Fig. D at end of this section.• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• After approach run of at least 10 m on hard and flat ground, measure travel deviation (X) in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 500	550
			High speed		Max. 500	550
	Hydraulic drift of travel	<ul style="list-style-type: none">★ For measuring posture, see Fig. F at end of this section.• Stop engine.• Hydraulic oil temperature: 45 – 55°C• Stop machine on slope of 30° with sprocket on upper side.• Measure hydraulic drift of travel in 5 minutes.	mm	0	0	
Leakage from travel motor	<ul style="list-style-type: none">• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• Lock shoe to relieve travel circuit.	ℓ/min.	—	—		
Work equipment	Whole work equipment (Hydraulic drift of bucket tooth tip)	<ul style="list-style-type: none">★ For measuring posture, see Fig. G at end of this section.• Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position.• Stop machine on level and flat ground.• Bucket: Rated load (Rated load: 1,422 N {145 kg})• Set lever in neutral.• Stop engine• Hydraulic oil temperature: 45 – 55°C• Start measurement just after setting.• Measure hydraulic drift every 5 minutes for 15 minutes.	mm	Max. 300	450	
	Boom cylinder (Retraction of cylinder)			Max. 20	30	
	Arm cylinder (Extension of cylinder)			Max. 20	30	
	Bucket cylinder (Retraction of cylinder)			Max. 20	30	
	Boom swing cylinder (Retraction and extension of cylinder)	<ul style="list-style-type: none">• Stop engine• Hydraulic oil temperature: 45 – 55°C• Bucket: Rated load (Rated load: 1,422 N {145 kg})• Set machine in above position on slope of 15° with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.		Max. 20	30	

Machine model				PC27MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Hydraulic drift	<ul style="list-style-type: none"> Stop engine Hydraulic oil temperature: 45 – 55°C Measure hydraulic drift of blade tip from maximum raising height for 15 minutes. 	mm	Max. 30	45
	Work equipment speed	★ For measuring posture, see Fig. H at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground.	RAISE	2.6 ± 0.3	3.0
			LOWER	2.6 ± 0.3	3.0
		★ For measuring posture, see Fig. I at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	IN	2.4 ± 0.3	3.4
			OUT	2.2 ± 0.3	3.1
		★ For measuring posture, see Fig. J at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	CURL	2.4 ± 0.3	3.0
			DUMP	2.0 ± 0.3	2.6
		★ For measuring posture, see Fig. K at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position.	RAISE	1.0 ± 0.3	1.6
			LOWER	1.0 ± 0.3	1.6
		★ For measuring posture, see Fig. L at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Measure time required to move cylinder between extension and retraction stroke ends.	Swing boom to LEFT	7.0 ± 1.5	10
			Swing boom to RIGHT	7.0 ± 1.5	10

Machine model				PC27MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Time lag	★ For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.	sec.	Max. 2	Max. 3.9
		★ For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.		Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	cc/min	Max. 2	10
		Leakage from center swivel joint		—	—
—	Performance of hydraulic pump		See section of “Performance of hydraulic pump”.		

Applicable model: PC30MR-3

Machine model				PC30MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	Speed when 1 pump is relieved	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CEngine oil pressure: Within operating rangeEngine coolant temperature: Within operating range		rpm	Min. 2,250	Min. 2,250
	Speed when 2 pumps are relieved	<ul style="list-style-type: none">Relief of 1 pump: Relieve bucket circuit.Relief of 2 pumps: Relieve bucket and swing circuits.			Min. 2,040	Min. 2,040
Stroke of control valve spool	Boom control valve	★ For details, see Fig. A at the end of this section.		mm	$l = 30$ $a = 6$ $b = 6$	$l = 30$ $a = 6$ $b = 6$
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	<ul style="list-style-type: none">Stop engine.Measure at center of lever grip.Measure at pedal tip.Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	85 ± 10	85 ± 10
	Arm control lever		N → IN, OUT		85 ± 10	85 ± 10
	Bucket control lever		N → CURL, DUMP		85 ± 10	85 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		85 ± 10	85 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 20	160 ± 20
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 5	Max. 5

Machine model				PC30MR-3		
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value	
Operating effort of control levers and pedals	Boom control lever	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CInstall push-pull scale to center of lever grip or pedal tip to measure.Read max. value to stroke end.	N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Arm control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Bucket control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Swing control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Boom swing control pedal			78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}	
	Blade control lever			29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}	
	Travel control lever			19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}	
	Fuel control lever			Idle → Full throttle	29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
				Full throttle → Idle	29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
Oil pressure	Unload pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CSet all levers in neutral.Run engine at full throttle.Measure pump outlet pressure.	MPa {kg/cm ² }	3.9 ^{+0.98} ₀ {39.6 ⁺¹⁰ ₀ }	3.9 ^{+0.98} ₀ {39.6 ⁺¹⁰ ₀ }	
	Boom relief pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle and measure relief pressure (Relieve only circuit to be measured).Measure pump outlet pressure.		26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	
	Arm relief pressure			26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	
	Bucket relief pressure			26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	
	Swing relief pressure			19.6 ± 0.98 {200 ± 10}	19.6 ± 0.98 {200 ± 10}	
	Boom swing relief pressure			26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	
	Blade relief pressure			Raise	21.6 ^{+0.98} _{−0.49} {220 ⁺¹⁰ _{−5} }	21.6 ^{+0.98} _{−0.49} {220 ⁺¹⁰ _{−5} }
		Lower		21.6 ^{+0.98} _{−0.49} {220 ⁺¹⁰ _{−5} }	21.6 ^{+0.98} _{−0.49} {220 ⁺¹⁰ _{−5} }	
	Travel relief pressure			26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	26.0 ^{+0.98} _{−0.49} {265 ⁺¹⁰ _{−5} }	
	Control circuit oil pressure (Oil pressure lowered by self pressure)	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Measure circuit oil pressure when all control levers are in neutral.Measure pump outlet pressure		2.94 ^{+0.49} _{−0.1} {30 ⁺⁵ _{−1} }	2.94 ^{+0.49} _{−0.1} {30 ⁺⁵ _{−1} }	

Machine model				PC30MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Pump outlet pressure – LS pressure	When all levers are in neutral	MPa {kg/cm ² }	$3.9 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {39.6 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }	$3.9 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {39.6 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }
			While bucket is curled with no load (full throttle)		1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}
Swing	Overrun of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CStop after swinging 1 turn and measure shifting distance of swing circle.Value in () is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to pass 90° and 180° points after starting swinging.	90°	sec.	2.3 ± 0.3	2.9
			180°		—	—
	Time required for swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to swing 5 turns after swinging 1 turn.			33 ± 3	38
	Hydraulic drift of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. C at end of this section.Max. reachStop engine.Hydraulic oil temperature: 45 – 55°CFill bucket with rated load or dirt and sand. (Rated load: 1,422 N {145 kg})Stop machine on slope of 15° and set its upper structure at 45° upward.Make match marks on swing circle outer race and track frame.Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CRelieve swing circuit and measure leakage in 1 minute.		cc/min.	—	—

Machine model				PC30MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Travel speed	<ul style="list-style-type: none">★ For measuring posture, see Fig. D at end of this section.• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• After approach run of at least 10 m on flat ground, measure time required to travel 20 m.• (): Machine with steel shoe specification	Low speed	sec.	27.7 ± 2 (26.9 ± 2)	27.7 ± 4 (26.9 ± 4)
			High speed		15.7 ± 2 (15.3 ± 2)	15.7 ± 4 (15.3 ± 4)
	Travel deviation	<ul style="list-style-type: none">★ For measuring posture, see Fig. D at end of this section.• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• After approach run of at least 10 m on hard and flat ground, measure travel deviation (X) in the travel of 20 m after approach run (For details, see Fig. E at end of this section).	Low speed	mm	Max. 300	330
			High speed		Max. 300	330
	Hydraulic drift of travel	<ul style="list-style-type: none">★ For measuring posture, see Fig. F at end of this section.• Stop engine.• Hydraulic oil temperature: 45 – 55°C• Stop machine on slope of 30° with sprocket on upper side.• Measure hydraulic drift of travel in 5 minutes.	mm	0	0	
Leakage from travel motor	<ul style="list-style-type: none">• Run engine at full throttle.• Hydraulic oil temperature: 45 – 55°C• Lock shoe to relieve travel circuit.	ℓ/min	—	—		
Work equipment	Whole work equipment (Hydraulic drift of bucket tooth tip)	<ul style="list-style-type: none">★ For measuring posture, see Fig. G at end of this section.• Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position.• Stop machine on level and flat ground.• Bucket: Rated load (Rated load: 1,422 N {145 kg})• Set lever in neutral.• Stop engine• Hydraulic oil temperature: 45 – 55°C• Start measurement just after setting.• Measure hydraulic drift every 5 minutes for 15 minutes.	mm	Max. 300	450	
	Boom cylinder (Retraction of cylinder)			Max. 20	30	
	Arm cylinder (Extension of cylinder)			Max. 20	30	
	Bucket cylinder (Retraction of cylinder)			Max. 20	30	
	Boom swing cylinder (Retraction and extension of cylinder)	<ul style="list-style-type: none">• Stop engine• Hydraulic oil temperature: 45 – 55°C• Bucket: Rated load (Rated load: 1,422 N {145 kg})• Set machine in above position on slope of 15° with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes.		Max. 20	30	

Machine model				PC30MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Hydraulic drift	<ul style="list-style-type: none"> Stop engine Hydraulic oil temperature: 45 – 55°C Measure hydraulic drift of blade tip from maximum raising height for 15 minutes. 	mm	Max. 30	45
	Work equipment speed	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. H at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground. 	RAISE	2.4 ± 0.3	3.2
			LOWER	2.6 ± 0.3	3.2
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. I at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	IN	2.4 ± 0.3	3.4
			OUT	2.2 ± 0.3	3.1
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. J at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	CURL	2.6 ± 0.3	3.2
			DUMP	2.0 ± 0.3	2.5
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. K at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position. 	RAISE	1.0 ± 0.3	1.6
			LOWER	1.0 ± 0.3	1.6
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. L at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	Swing boom to LEFT	7.1 ± 1.5	10
			Swing boom to RIGHT	7.3 ± 1.5	10

Machine model				PC30MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Time lag	★ For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.	sec.	Max. 2	Max. 3.9
		★ For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.		Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	cc/min	Max. 2	10
		Leakage from center swivel joint		—	—
—	Performance of hydraulic pump		See section of “Performance of hydraulic pump”.		

Applicable model: PC35MR-3

Machine model				PC35MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	Speed when 1 pump is relieved	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CEngine oil pressure: Within operating rangeEngine coolant temperature: Within operating rangeRelief of 1 pump: Relieve bucket circuit.Relief of 2 pumps: Relieve bucket and swing circuits.		rpm	Min. 2,160	Min. 2,160
	Speed when 2 pumps are relieved				Min. 1,955	Min. 1,955
Stroke of control valve spool	Boom control valve	★ For details, see Fig. A at the end of this section.		mm	$\ell = 30$ $a = 6$ $b = 6$	$\ell = 30$ $a = 6$ $b = 6$
	Arm control valve					
	Bucket control valve					
	Swing control valve					
	Breaker control valve					
	Boom swing control valve					
	Blade control valve					
	Left travel control valve					
	Right travel control valve					
Stroke of control lever and pedal	Boom control lever	<ul style="list-style-type: none">Stop engine.Measure at center of lever grip.Measure at pedal tip.Read max. value to stroke end (excluding neutral play).	N → RAISE, LOWER	mm	85 ± 10	85 ± 10
	Arm control lever		N → IN, OUT		85 ± 10	85 ± 10
	Bucket control lever		N → CURL, DUMP		85 ± 10	85 ± 10
	Swing control lever		N → Swing to LEFT, RIGHT		85 ± 10	85 ± 10
	Boom swing control pedal		N → Swing boom to LEFT, RIGHT		25 ± 5	25 ± 5
	Blade control lever		N → RAISE, LOWER		50 ± 5	50 ± 5
	Travel control lever		N → FORWARD, REVERSE		100 ± 10	100 ± 10
	Fuel control lever		SLOW ↔ FULL THROTTLE		160 ± 10	160 ± 10
	Play of control lever		Work equipment, swing		Max. 5	Max. 5
			Travel		Max. 5	Max. 5

Machine model				PC35MR-3		
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value	
Operating effort of control levers and pedals	Boom control lever	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CInstall push-pull scale to center of lever grip or pedal tip to measure.Read max. value to stroke end.	N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Arm control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Bucket control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Swing control lever			15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 9.8 {1.6 ± 1}	
	Boom swing control pedal			78.4 ± 19.6 {8.0 ± 2.0}	78.4 ± 29.4 {8.0 ± 3.0}	
	Blade control lever			29.4 ± 9.8 {3.0 ± 1.0}	29.4 ± 19.6 {3.0 ± 2}	
	Travel control lever			19.6 ± 4.9 {2.0 ± 0.5}	19.6 ± 9.8 {2.0 ± 1}	
	Fuel control lever			Idle → Full throttle	29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}
		Full throttle → Idle	29.4 ± 14.7 {3.0 ± 1.5}	29.4 ± 29.4 {3.0 ± 3}		
Oil pressure	Unload pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CSet all levers in neutral.Run engine at full throttle.Measure pump outlet pressure.	MPa {kg/cm ² }	3.2 ^{+0.98} ₀ {33 ⁺¹⁰ ₀ }	3.2 ^{+0.98} ₀ {33 ⁺¹⁰ ₀ }	
	Boom relief pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle and measure relief pressure (Relieve only circuit to be measured).Measure pump outlet pressure.		26.0 ± 0.98 {265 ± 10}	26.0 ± 0.98 {265 ± 10}	
	Arm relief pressure			26.0 ± 0.98 {265 ± 10}	26.0 ± 0.98 {265 ± 10}	
	Bucket relief pressure			26.0 ± 0.98 {265 ± 10}	26.0 ± 0.98 {265 ± 10}	
	Swing relief pressure			19.6 ± 0.98 {200 ± 10}	19.6 ± 0.98 {200 ± 10}	
	Boom swing relief pressure			26.0 ± 0.98 {265 ± 10}	26.0 ± 0.98 {265 ± 10}	
	Blade relief pressure			Raise	21.6 ^{+0.98} _{-0.49} {220 ⁺¹⁰ ₋₅ }	21.6 ^{+0.98} _{-0.49} {220 ⁺¹⁰ ₋₅ }
				Lower	21.6 ^{+0.98} _{-0.49} {220 ⁺¹⁰ ₋₅ }	21.6 ^{+0.98} _{-0.49} {220 ⁺¹⁰ ₋₅ }
	Travel relief pressure				26.0 ^{+0.98} _{-0.49} {265 ⁺¹⁰ ₋₅ }	26.0 ^{+0.98} _{-0.49} {265 ⁺¹⁰ ₋₅ }
	Control circuit oil pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Measure circuit oil pressure when all control levers are in neutral.Measure pump outlet pressure		3.73 ^{+0.39} _{-0.1} {38 ⁺⁴ ₋₁ }	3.73 ^{+0.39} _{-0.1} {38 ⁺⁴ ₋₁ }	

Machine model				PC35MR-3		
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Oil pressure	LS differential pressure	<ul style="list-style-type: none">Hydraulic oil temperature: 45 – 55°CRun engine at full throttle.Pump outlet pressure – LS pressure	When all levers are in neutral	MPa {kg/cm ² }	$3.2 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {33 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }	$3.2 \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ {33 $\begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ }
		While bucket is curled with no load (full throttle)	1.41 ± 0.1 {14.4 ± 1}		1.41 ± 0.1 {14.4 ± 1}	
Swing	Overrun of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CStop after swinging 1 turn and measure shifting distance of swing circle.Value in () is shifting distance of outside of swing circle.		deg. (mm)	Max. 40 (–)	50 (–)
	Time required to start swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to pass 90° and 180° points after starting swinging.	90°	sec.	2.2 ± 0.3	2.8
			180°		—	—
	Time required for swinging	<ul style="list-style-type: none">★ For measuring posture, see Fig. B at end of this section.No load, max. reachRun engine at full throttle.Hydraulic oil temperature: 45 – 55°CMeasure time required to swing 5 turns after swinging 1 turn.			33 ± 4	41
	Hydraulic drift of swing	<ul style="list-style-type: none">★ For measuring posture, see Fig. C at end of this section.Max. reachStop engine.Hydraulic oil temperature: 45 – 55°CFill bucket with rated load or dirt and sand. (Rated load: 1,422 N {145 kg})Stop machine on slope of 15° and set its upper structure at 45° upward.Make match marks on swing circle outer race and track frame.Measure shifting distance of match marks in 15 minutes.		deg. (mm)	0 (0)	0 (0)
	Leakage from swing motor	<ul style="list-style-type: none">Run engine at full throttle.Hydraulic oil temperature: 45 – 55°CRelieve swing circuit and measure leakage in 1 minute.		cc/min.	—	—

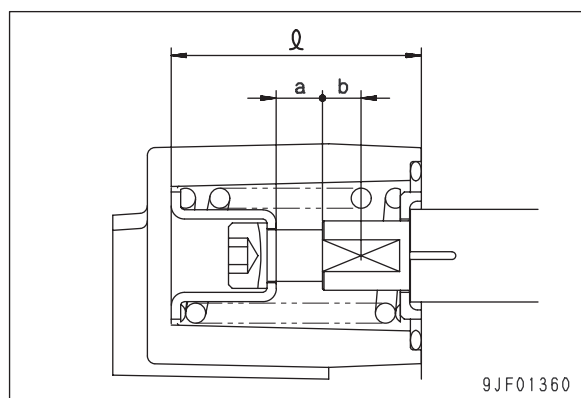
Machine model				PC35MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Travel	Travel speed	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on flat ground, measure time required to travel 20 m. • (): Machine with steel shoe specification 	Low speed	25.7 ± 2 (26.7 ± 2)	25.7 ± 4 (26.7 ± 4)
			High speed	15.0 ± 2 (16.0 ± 2)	15.0 ± 4 (16.0 ± 4)
	Travel deviation	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. D at end of this section. • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • After approach run of at least 10 m on hard and flat ground, measure travel deviation (X) in the travel of 20 m after approach run (For details, see Fig. E at end of this section). 	Low speed	Max. 300	330
			High speed	Max. 300	330
	Hydraulic drift of travel	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. F at end of this section. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Stop machine on slope of 30° with sprocket on upper side. • Measure hydraulic drift of travel in 5 minutes. 	mm	0	0
	Leakage from travel motor	<ul style="list-style-type: none"> • Run engine at full throttle. • Hydraulic oil temperature: 45 – 55°C • Lock shoe to relieve travel circuit. 	ℓ/min.	—	—
Work equipment	Whole work equipment (Hydraulic drift of bucket tooth tip)	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. G at end of this section. • Measure extension and retraction of each cylinder and lowering of bucket tooth tip from above position. • Stop machine on level and flat ground. • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set lever in neutral. • Stop engine. • Hydraulic oil temperature: 45 – 55°C • Start measurement just after setting. • Measure hydraulic drift every 5 minutes for 15 minutes. 	mm	Max. 300	450
	Boom cylinder (Retraction of cylinder)			Max. 10	15
	Arm cylinder (Extension of cylinder)			Max. 29	44
	Bucket cylinder (Retraction of cylinder)			Max. 16	24
	Boom swing cylinder (Retraction and extension of cylinder)	<ul style="list-style-type: none"> • Stop engine • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load (Rated load: 1,422 N {145 kg}) • Set machine in above position on slope of 15° with upper structure at right angle to its body and measure retraction and extension of cylinder for 15 minutes. 		Max. 20	30

Machine model				PC35MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Hydraulic drift	<ul style="list-style-type: none"> Stop engine Hydraulic oil temperature: 45 – 55°C Measure hydraulic drift of blade tip from maximum raising height for 15 minutes. 	mm	Max. 30	45
	Work equipment speed	<ul style="list-style-type: none"> ★ For measuring posture, see Fig. H at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension stroke end and position at which bucket tooth is in contact with ground. 	RAISE	2.4 ± 0.3	3.0
			LOWER	2.6 ± 0.3	3.2
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. I at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	IN	2.4 ± 0.3	3.0
			OUT	2.2 ± 0.3	2.6
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. J at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	CURL	2.6 ± 0.3	3.2
			DUMP	2.0 ± 0.3	2.6
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. K at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between position at which blade is in contact with ground and maximum blade raising position. 	RAISE	1.0 ± 0.3	1.6
			LOWER	1.0 ± 0.3	1.6
		<ul style="list-style-type: none"> ★ For measuring posture, see Fig. L at end of this section. Run engine at full throttle. Hydraulic oil temperature: 45 – 55°C Measure time required to move cylinder between extension and retraction stroke ends. 	Swing boom to LEFT	7.5 ± 1.5	10
			Swing boom to RIGHT	7.5 ± 1.5	10

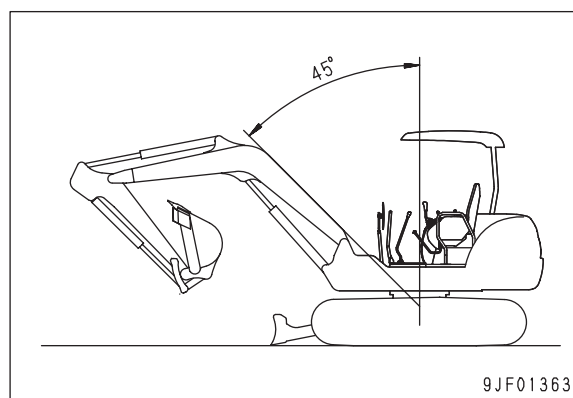
Machine model				PC35MR-3	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Time lag	★ For measuring posture, see Fig. M at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set arm to OUT stroke end, bucket to DUMP stroke end, and boom at RAISE stroke end. Then, lower bucket and measure time required to raise machine after bucket touches ground.	sec.	Max. 2	Max. 3.9
		★ For measuring posture, see Fig. N at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, bucket to DUMP stroke end, and arm to IN stroke end. Then, move arm IN and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. O at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Set upper side of boom horizontally, arm to IN stroke end, and bucket to DUMP stroke end. Then, CURL bucket and measure time required to start it again after it stops temporarily.		Max. 1	Max. 2
		★ For measuring posture, see Fig. P at end of this section. • Run engine slow. • Hydraulic oil temperature: 45 – 55°C • Lower blade from RAISE stroke end and measure time required to raise machine after blade touches ground.		Max. 2	Max. 3.9
	Internal leakage	Leakage from each cylinder	cc/min	Max. 2	10
		Leakage from center swivel joint		—	—
—	Performance of hydraulic pump		See section of “Performance of hydraulic pump”.		

Posture of machine for measuring performance and measurement procedure

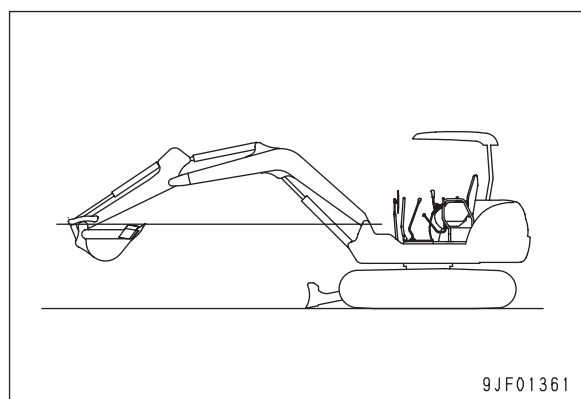
★ Fig. A



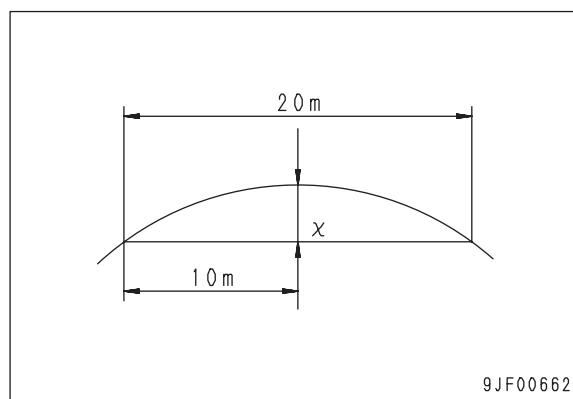
★ Fig. D



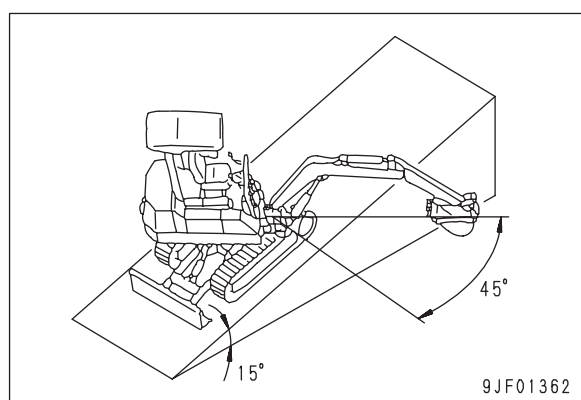
★ Fig. B



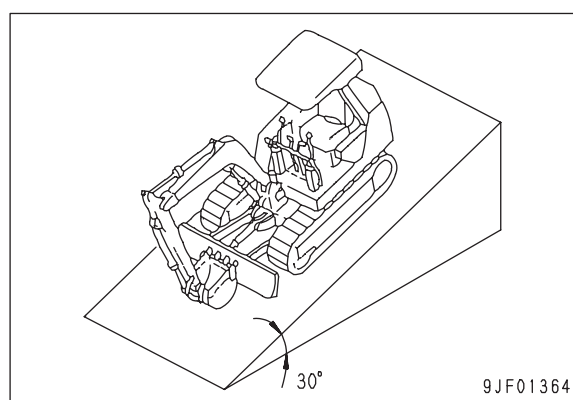
★ Fig. E



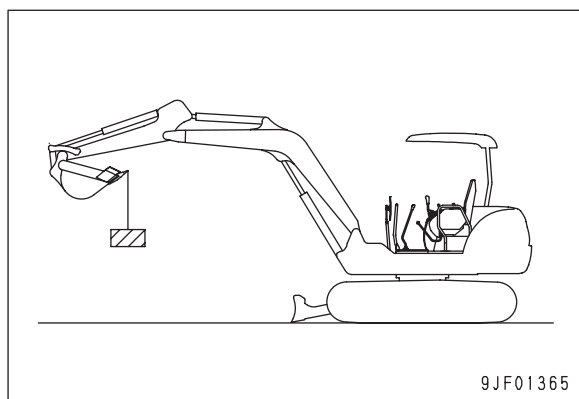
★ Fig. C



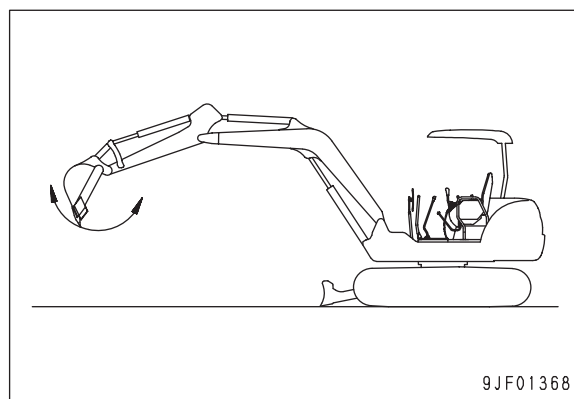
★ Fig. F



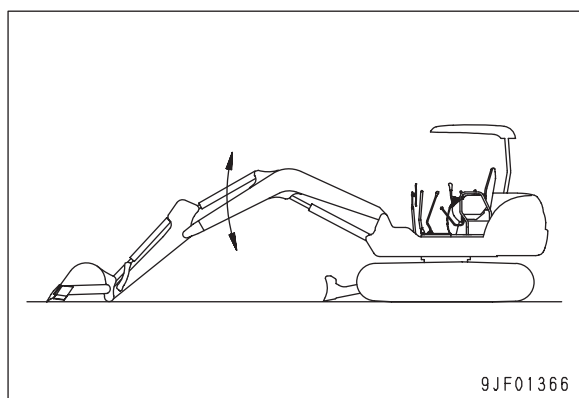
★ Fig. G



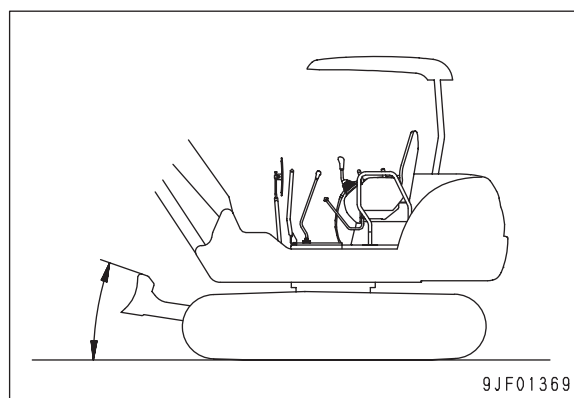
★ Fig. J



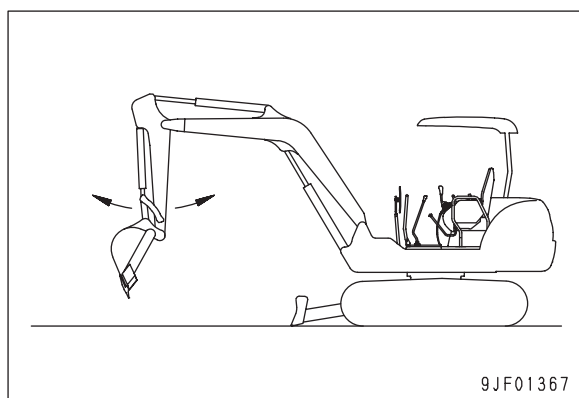
★ Fig. H



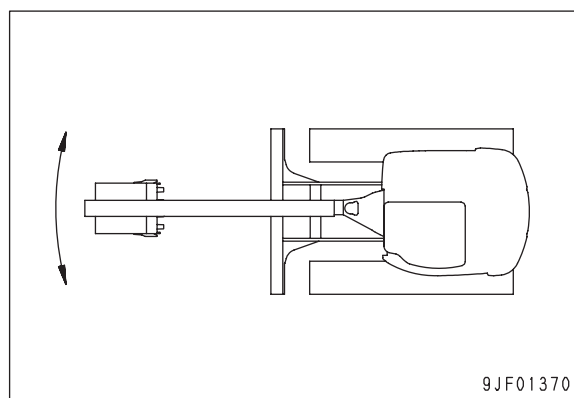
★ Fig. K



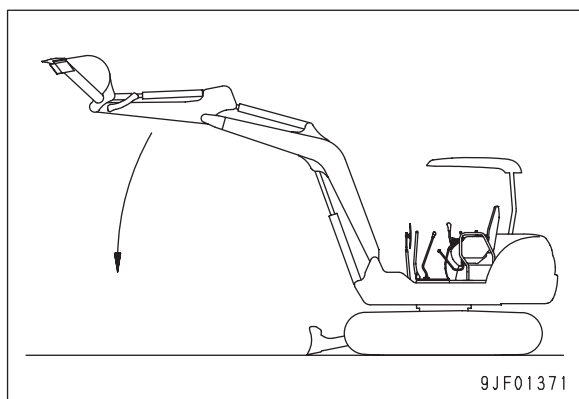
★ Fig. I



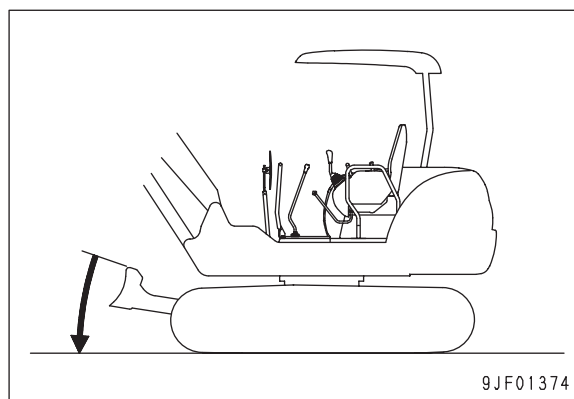
★ Fig. L



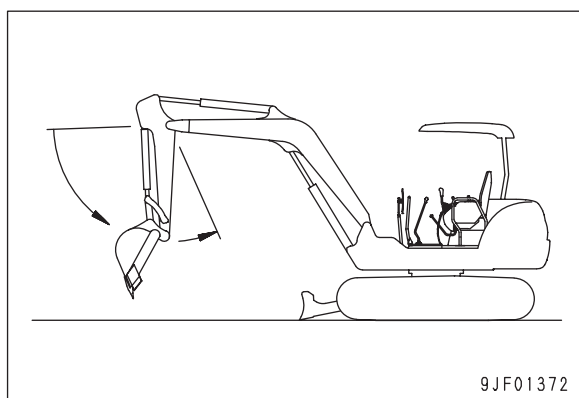
★ Fig. M



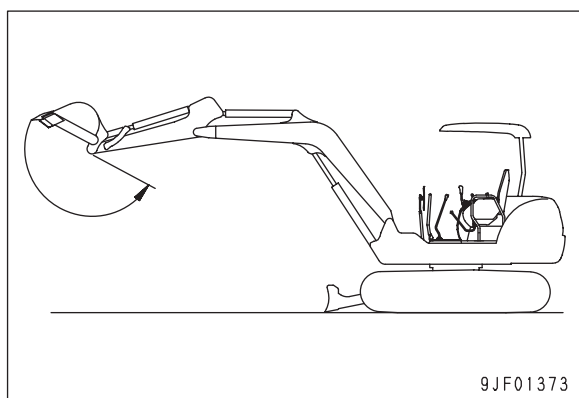
★ Fig. P



★ Fig. N



★ Fig. O

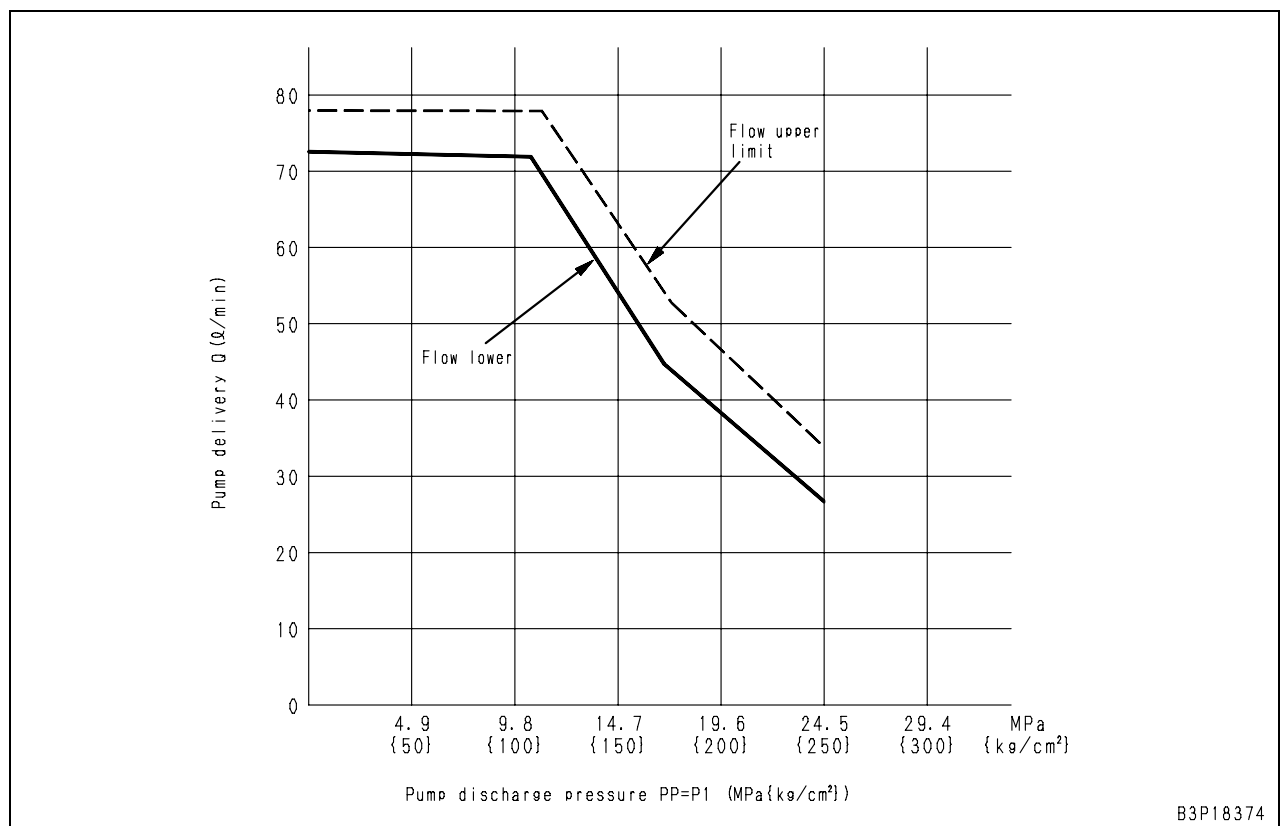


Performance of hydraulic pump

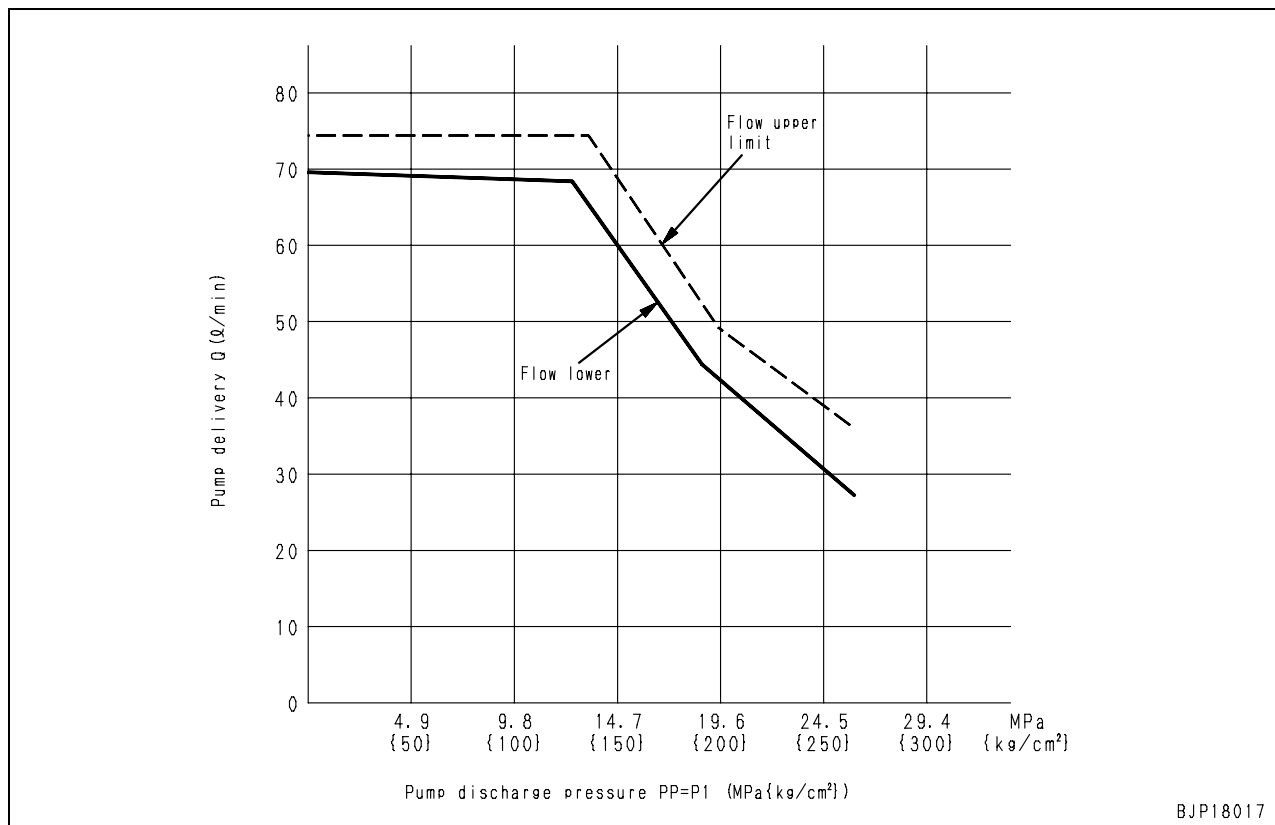
Item	Measurement conditions	Machine model	Unit	Standard value for new machine	Service limit value
Discharge of gear pump	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 – 55°C Run engine at rated speed. Measure at set pressure of relief valve. 	PC27MR-3	ℓ/min.	21.4	16.1
		PC30MR-3		19.8	16.8
		PC35MR-3		19.8	16.1

Item	Measurement conditions	Machine model	Checkpoint	Discharge pressure of test pump (MPa{kg/cm ² })	Discharge pressure of the other pump (MPa{kg/cm ² })	Average discharge pressure (MPa{kg/cm ² })	Standard discharge Q (ℓ/min)	Criterion Q (ℓ/min)
Discharge of piston pump	<ul style="list-style-type: none"> Hydraulic oil temperature: 45 – 55°C Engine speed: 2,500 rpm Apply no load to gear pump. ★ Avoid measuring near broken part of graph since error become large at that part. 	PC27MR-3	Any point	P1	—	P	★ See Fig. Q.	★ See Fig. Q.
		PC30MR-3					★ See Fig. R.	★ See Fig. R.
		PC35MR-3			P2	(P1+P2)/2	★ See Fig. S.	★ See Fig. S.

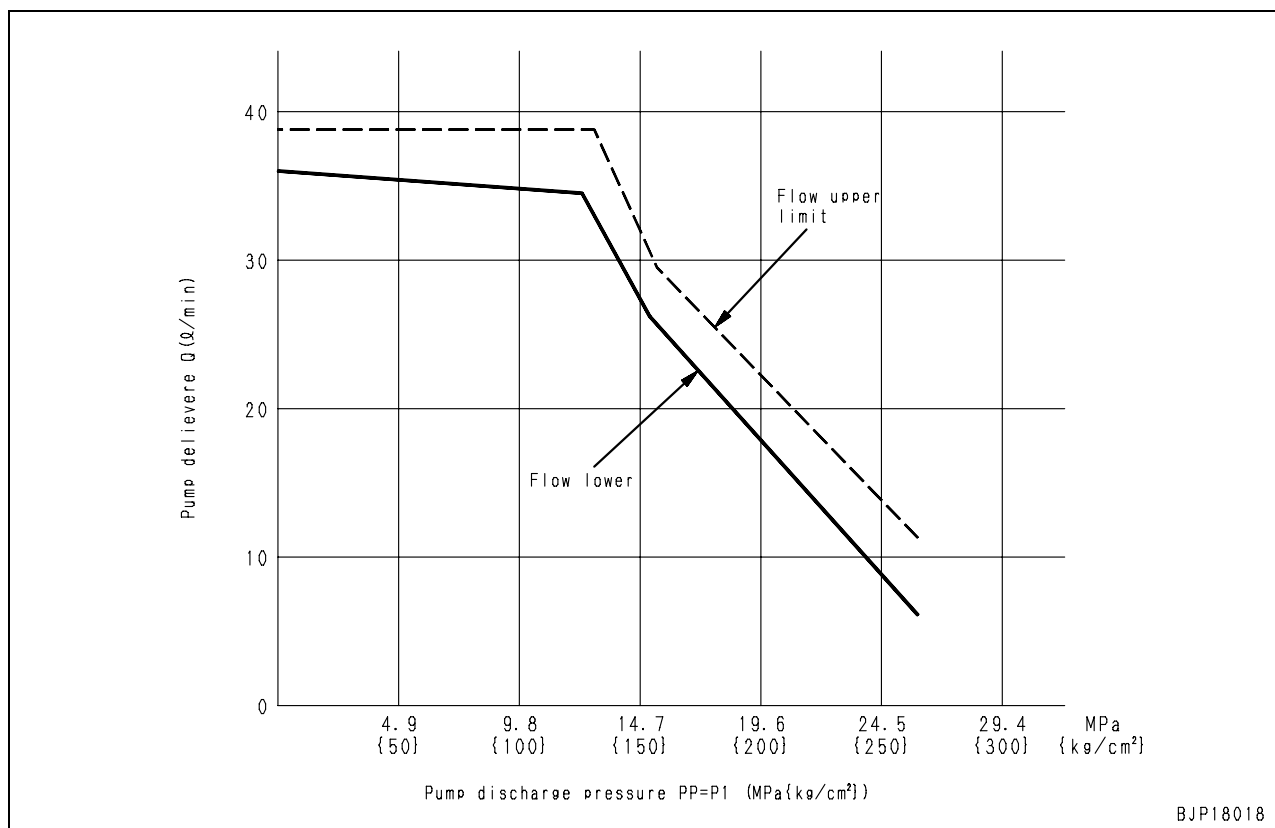
★ Fig. Q



★ Fig. R



★ Fig. S



PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04380-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

30 Testing and adjusting

100 Testing and adjusting

Tools for testing, adjusting, and troubleshooting	3
Testing engine speed	6
Testing exhaust gas color	7
Testing and adjusting valve clearance	8
Testing compression pressure	9
Testing engine oil pressure	10
Testing and adjusting fuel injection timing.....	11
Testing and adjusting alternator belt tension.....	15
Testing and adjusting air conditioner compressor belt tension	16
Adjusting fuel control lever	17
Testing clearance in swing circle bearings.....	18
Testing and adjusting track shoe tension	19
Testing and adjusting oil pressures in work equipment, travel, boom swing, swing, and blade circuits.....	20
Testing and adjusting LS differential pressure	25
Adjusting PC valve	28
Testing and adjusting control pump circuit oil pressure	29
Testing solenoid valve output pressure.....	31
Testing PPC valve output pressure	32
Adjusting PPC valve	36
Testing swing holding brake release pressure	37
Testing and adjusting travel deviation	38
Testing oil leakage from work equipment cylinder	40
Bleeding air from each part.....	42

Releasing residual pressure from hydraulic circuit.....	44
Releasing residual pressure from hydraulic tank	45
Pressurizing hydraulic tank	45
How to open and close (tilt) floor.....	46
Inspection procedures for diode.....	51
How to start operation of KOMTRAX terminal	52
Lamp display of KOMTRAX terminal	56
Removal and installation of KOMTRAX terminal	59
Preparation work for troubleshooting of electrical system.....	60

Tools for testing, adjusting, and troubleshooting

Testing/Adjusting item	Symbol	Part No.	Part Name	Q'ty	Remarks
Testing engine speed	A	799-205-1100	Tachometer kit	1	Digital display: 6.0 – 99,999.9 rpm
Testing coolant temperature, oil temperature, and exhaust temperature	B	799-101-1502	Digital thermometer	1	– 99.9 – 1,299°C
Testing exhaust gas color	C	1 799-201-9001	Handy smoke checker	1	Bosch index 0 – 9 (With standard color)
		2 Commercially available	Smoke meter	1	—
Adjusting valve clearance	D	Commercially available	Clearance gauge	1	—
Testing compression pressure	E	1 795-502-1590	Compression gauge	1	0 – 7 MPa {0 – 70 kg/cm ² } KIT No.: 795-502-1205
		2 795-111-1130	Adapter	1	—
		3 795-101-1571	Joint	1	—
Testing engine oil pressure	F	1 799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2 799-401-2320	Oil pressure gauge	1	Pressure gauge: 1 MPa {10 kg/cm ² }
Testing and adjusting fuel injection timing	Q	1 795-111-1140	Adapter	1	
		2 795-111-1150	Clamp	1	
		3 Commercially available	Dial gauge	1	
		4 795-111-1160	Extension rod	1	
Testing and adjusting oil pressures in work equipment, travel, boom swing, swing, and blade circuits	G	1 799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2 799-101-5220	Nipple	1	10 × 1.25 mm
		07002-11023	O-ring	1	—
Testing LS differential pressure	H	1 799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2 799-101-5220	Nipple	2	10 × 1.25 mm
		07002-11023	O-ring	2	—
		3 799-401-2701	Differential pressure gauge	1	—
		4 799-401-3100	Adapter	1	Face seal type (#02)
		02896-11008	O-ring	1	Both male and female: 9/16-18UNF (Female: R1/8)
		5 799-401-3200	Adapter	1	Face seal type (#03)
		02896-11009	O-ring	1	Both male and female: 11/16-16UNF (Female: R1/8)

Testing/Adjusting item	Sym- bol	Part No.	Part Name	Q'ty	Remarks	
Testing control circuit oil pressure (oil pressure reduced by self pressure)	J	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: R1/8)
			02896-11008	O-ring	1	
Testing and adjusting control pump circuit oil pressure	K	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2	799-101-5220	Nipple	1	10 × 1.25 mm
			07002-11023	O-ring	1	—
Testing solenoid valve output pressure	L	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: R1/8)
			02896-11008	O-ring	1	
Testing PPC valve output pressure and swing holding brake release pressure	M	1	799-101-5002	Oil pressure gauge kit (Analog)	1	Pressure gauge: 2.5, 6, 40, 60 MPa {25, 60, 400, 600 kg/cm ² }
			790-261-1204	Oil pressure gauge kit (Digital)	1	Pressure gauge: 60 MPa {600 kg/cm ² }
		2	799-401-3100	Adapter	1	Face seal type (#02) Both male and female: 9/16-18UNF (Female: R1/8)
			02896-11008	O-ring	1	
Testing leakage from work equipment cylinder	N	Commercially available	Measuring cylinder	1	—	
Testing swing circle bearing clearance	P	Commercially available	Dial gauge	1	—	
Testing operating effort and pressing force	—	79A-264-0021	Push-pull scale	1	0 – 300 N {0 – 30 kg}	
		79A-264-0091		1	0 – 500 N {0 – 50 kg}	
Testing stroke and hydraulic drift	—	Commercially available	Scale	1	—	
Testing work equipment speed	—	Commercially available	Stopwatch	1	—	
Testing voltage and resistance	—	Commercially available	Multimeter	1	—	
Diagnosis for chassis side sensor, actuator and harness	—	799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter assembly	1		
		799-601-2600	• T-adapter	1	For ECONO *3 (Max. 21P) (Excl. 799-601-7000)	
		799-601-7090	• T-adapter	1	For M2P	
		799-601-7110	• T-adapter		For M3P	
		799-601-7050	• T-adapter		For SWP6P (Excl. 799-601-8000)	
		799-601-7060	• T-adapter		For SWP8P (Excl. 799-601-8000)	

Testing/Adjusting item	Sym- bol	Part No.	Part Name	Q'ty	Remarks
Diagnosis for chassis side sensor, actuator and harness	—	799-601-7310	• T-adapter		For SWP12P (Excl. 799-601-8000)
		799-601-7010	• T-adapter		For X1P
		700-601-7020	• T-adapter		For X2P
		700-601-7040	• T-adapter		For X4P
		799-601-7500	T-adapter assembly		
		799-601-7520	• T-adapter		For AMP070-12P
		799-601-7540	• T-adapter		For AMP070-18P
		799-601-7550	• T-adapter		For AMP070-20P
		799-601-9000 or 799-601-9200	T-adapter assembly		
		799-601-9040	• T-adapter		For DT2P (Incl. in 799-601-4101 and 799-601-4201)
		799-601-9020	• T-adapter		For DT2P
		799-601-9030	• T-adapter		For DT3P
		799-601-9050	• T-adapter		For DT6P
		799-601-9060	• T-adapter		For DT8P (Gray)
		799-601-9070	• T-adapter		For DT8P (Black)
		799-601-9080	• T-adapter		For DT8P (Green)
		799-601-9090	• T-adapter		For DT8P (Brown)
		799-601-9110	• T-adapter		For DT12P (Gray)
		799-601-9120	• T-adapter		For DT12P (Black)
		799-601-9130	• T-adapter		For DT12P (Green)
		799-601-9140	• T-adapter		For DT12P (Brown)
		799-601-7360	T-adapter assembly		For 5P-relay (Kit No. is not registerd)
		799-601-7370	T-adapter assembly		For 6P-relay (Kit No. is not registerd)
		799-601-9420	T-adapter assembly		For AMP3P (Incl. in 799-601-4101 and 799-601-4201)

Testing engine speed

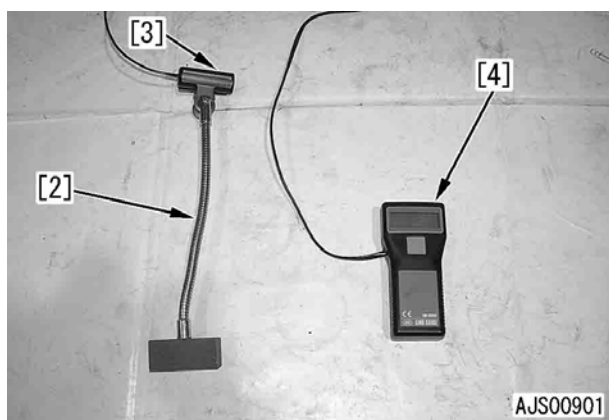
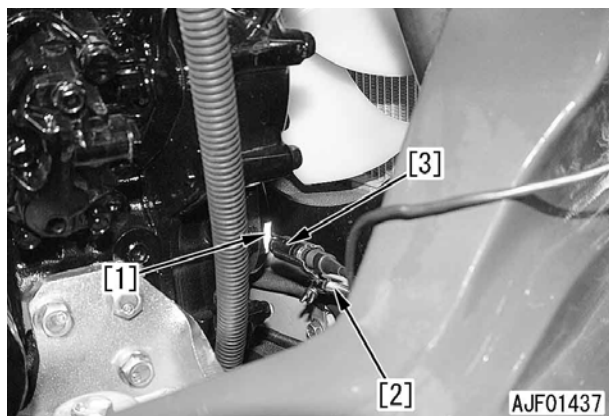
★ Measuring instruments for engine speed

Symbol	Part No.	Part Name
A	799-205-1100	Tachometer kit

- ★ Measure the engine speed under the following condition.
- Engine coolant temperature:
Within operating range
- Hydraulic oil temperature: 45 – 55°C

⚠ When installing and removing the measuring instruments, take care not to touch a hot part of the engine.

1. Open the engine rear cover.
2. Stick reflection tape [1] of tachometer kit **A** to the crankshaft pulley.
3. Set probe [3] with stand [2], matching it to reflection tape [1], and connect it to tachometer [4].



4. Run the engine and measure the engine speed under the following condition.
 - 1) Measuring low idle and high idle speeds:
Set the fuel control lever to the low idle and high idle positions and measure the engine speed.
 - 2) Measuring pump relief engine speed:
Lock the work equipment or travel system to relieve the main pump, run the engine at full throttle, and measure the engine speed.

Testing exhaust gas color

★ Measuring instruments for exhaust gas color

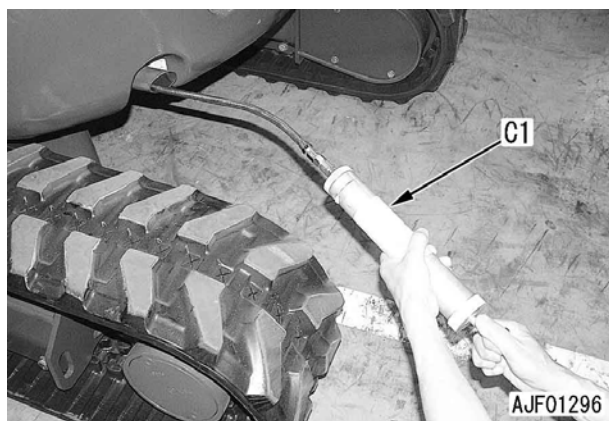
Symbol	Part No.	Part Name
C	1	799-201-9001 Handy smoke checker
	2	Commercially available Smoke meter

⚠ Be careful not to touch the highly heated parts, while fitting and detaching a measurement tool.

- ★ If no compressed air or power is not available in the field, use Handy Smoke Checker **C1**. For recording official data, use Smoke Meter **C2**.
- ★ Measure the exhaust gas color under the following condition.
 - Engine coolant temperature:
Within operating range

1. Measurement with handy smoke checker C1

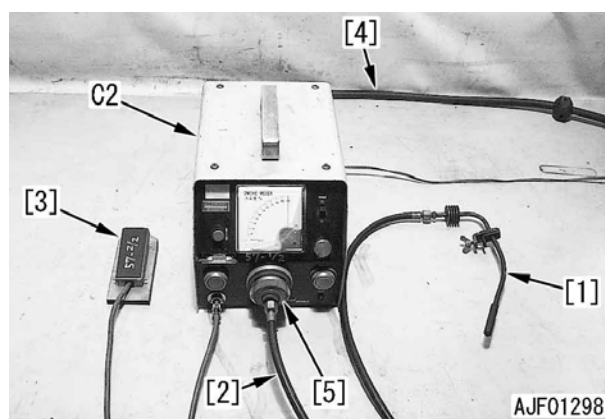
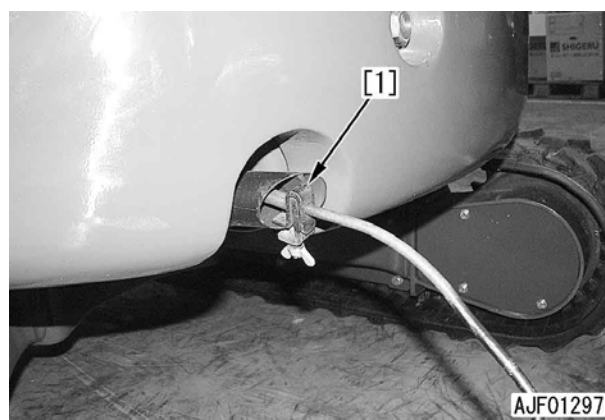
- 1) Fit a filtering paper to handy smoke checker **C1**.
- 2) Insert the exhaust gas intake pipe into the exhaust pipe.
- 3) Accelerate the engine sharply and operate the handle of smoke checker **C1** simultaneously to let the exhaust gas stay on the filtering paper.
- 4) Take out the filtering paper and compare it with the attached scale for judgement.



2. Measurement with smoke meter C2

- 1) Insert probe [1] of the smoke meter **C2** into the exhaust gas pipe outlet, and fasten it to the outlet with a clip.
- 2) Connect the probe hose [2], accelerator switch [3] outlet and air hose [4] to the smoke meter **C2**.
 - ★ Keep the pressure of the supplied compressed air below 1.47 MPa {15 kg/cm²}.

- 3) Connect the power cable to AC socket.
 - ★ Confirm that the smoke meter power switch is in the OFF position, before connecting the power cable to an outlet.
- 4) Fit a filtering paper by loosening the suction pump cap nut [5].
 - ★ Fit the filtering paper securely so that air may not leak.
- 5) Move the smoke meter **C2** power switch to the ON position.
- 6) Accelerate the engine sharply and depress accelerator pedal [3] of smoke meter **C2** simultaneously to let the exhaust gas stay on the filtering paper.
- 7) Put the polluted filtering paper on non-polluted filtering paper (more than 10 sheets) in the filtering paper holder, and read the indicated value.



Testing and adjusting valve clearance

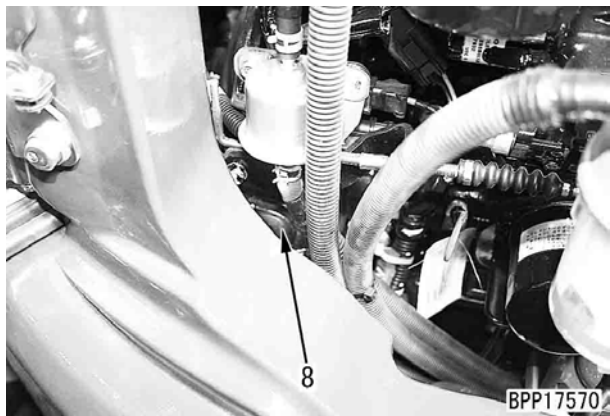
- ★ Measuring and adjusting tools for valve clearance

Symbol	Part No.	Part Name
D	Commercially available	Clearance gauge

1. Tilt up the floor frame.
For details, see "How to open and close (tilt) floor".
2. Remove cylinder head cover (7).



3. Remove the inspection window cap (8) of the flywheel housing.



4. Watching the movement of the valve of the No. 3 cylinder (on the radiator side), rotate the crankshaft forward to match stamp line (a) of the flywheel housing to stamp line (b) of flywheel No. 3.
★ The cylinder on the flywheel side is the No. 1 cylinder.

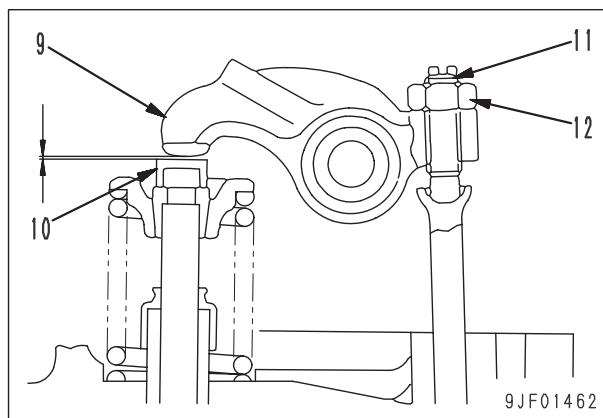
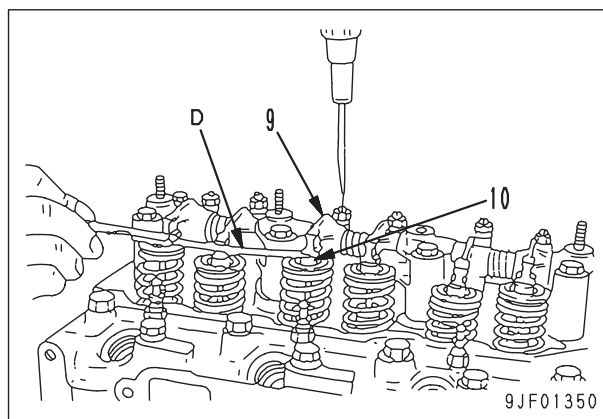
- ★ When the cylinder piston is at the compression top dead center, the rocker arms of both intake valve and exhaust valve can be moved by the valve clearance. If the rocker arms do not move, rotate the crankshaft 1 more turn.

5. Insert clearance gauge **D** between rocker arm (9) and valve cap (10) to check the valve clearance.
6. If the valve clearance is out of the standard value, loosen locknut (12) and insert clearance gauge **D** between rocker arm (9) and valve cap (10) and adjust the clearance with adjustment screw (11) so that the clearance gauge will move lightly and then tighten locknut (12).

Locknut:

$25.48 \pm 2.94 \text{ Nm} \{2.6 \pm 0.3 \text{ kgm}\}$

- ★ Rotate the crankshaft by 240° and adjust the valve clearance of each cylinder in the firing order.
- Firing order: 1 – 3 – 2
- ★ There is a stamp line on the flywheel for the top dead center of each cylinder.



7. After finishing adjustment, tilt down the floor frame.
For details, see "How to open and close (tilt) floor".

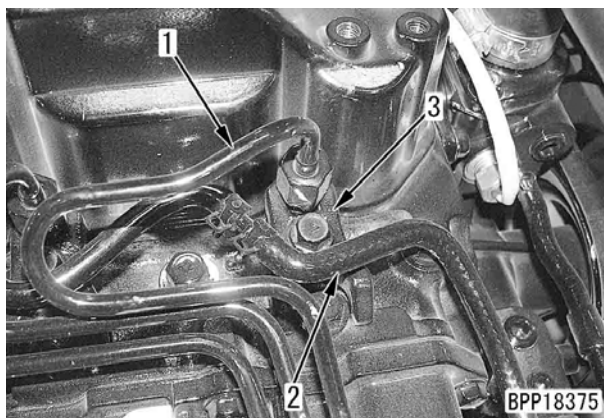
Testing compression pressure

- ★ Measuring instruments for compression pressure

Symbol	Part No.	Part Name
E	1	795-502-1590 Compression gauge
	2	795-111-1130 Adapter
	3	795-101-1571 Joint

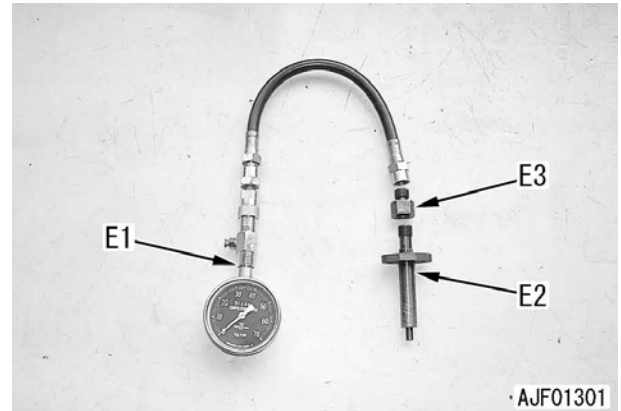
⚠ When measuring the compression pressure, take care not to burn yourself on the exhaust manifold, muffler, etc. or get caught in the fan, fan belt, or another rotating part.

1. Adjust the valve clearance.
For details, see "Testing and adjusting valve clearance".
2. Warm up the engine until the engine oil temperature rises to 40 – 60°C.
3. Remove fuel tube (1), spil hose (2) and nozzle holder assembly (3) of the cylinder to be measured.

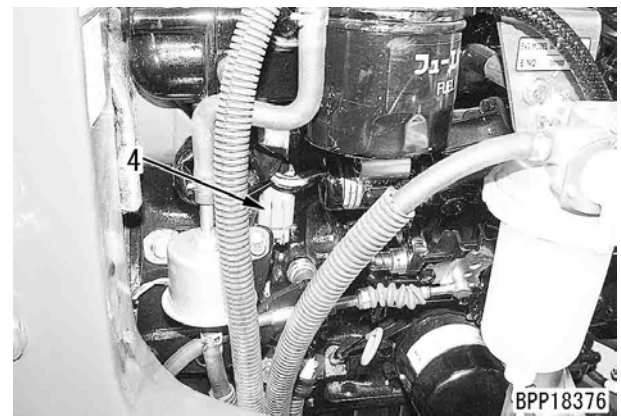


4. Install adapter **E2** and joint **E3** to the nozzle holder mounting part and connect compression gauge **E1**.

⌚ Adapter mounting nut:
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}



5. Disconnect connector (4) of the engine stop motor.



6. Crank the engine with the starting motor and measure the compression pressure.

★ Read the compression gauge when its pointer is stabilized.

★ After measuring the compression pressure, install the nozzle holder assembly.

⌚ Nozzle holder assembly mounting nut:
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}

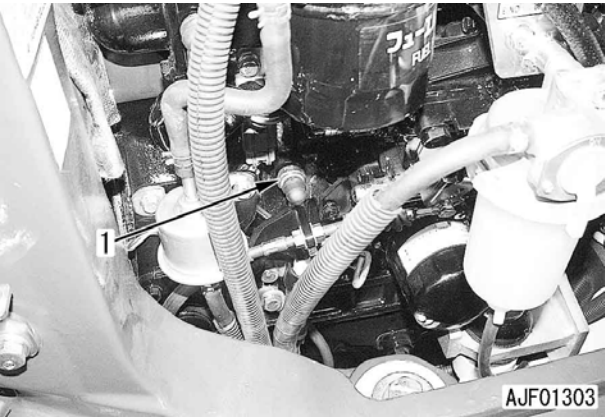
⌚ Fuel tube mounting nut:
29 – 34 Nm {3.0 – 3.5 kgm}

Testing engine oil pressure

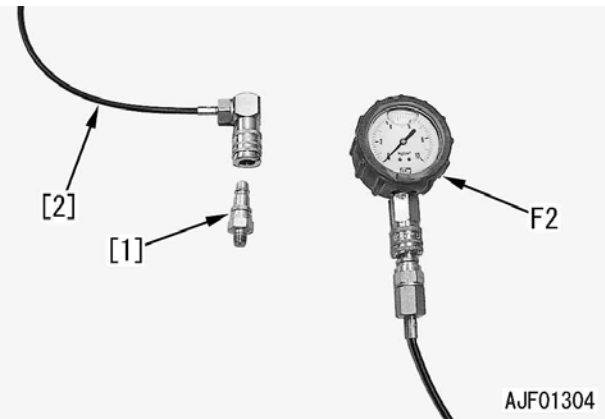
★ Measuring instruments for engine oil pressure

Symbol	Part No.	Part Name
F	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-401-2320 Oil pressure gauge

- ★ Measure the engine oil pressure under the following condition.
- Coolant temperature: Within operating range
1. Open the engine side cover and remove engine oil pressure switch (1).



2. Install nipple [1] of oil pressure gauge kit **F1** and connect oil pressure gauge **F2** (1 MPa {10 kg/cm²}) by hose [2].



3. Start the engine and measure the oil pressure at low idle and high idle.

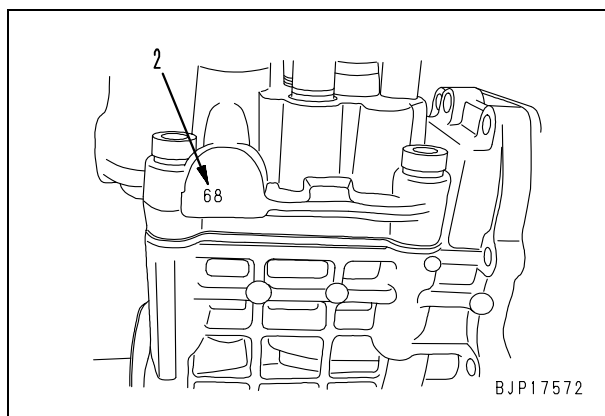
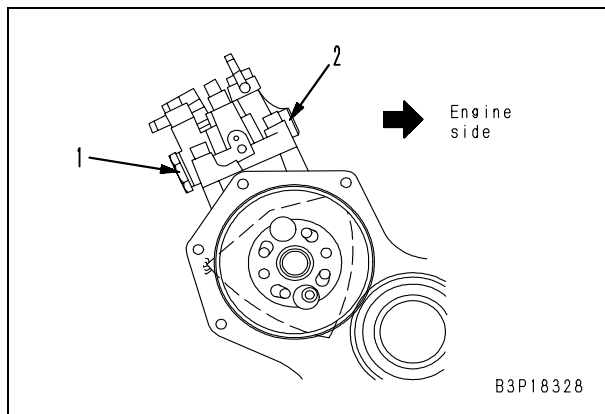
Testing and adjusting fuel injection timing

- ★ Testing and adjusting tools for fuel injection timing

Symbol	Part No.	Part Name
Q	1	795-111-1140 Adapter
	2	795-111-1150 Clamp
	3	Commercially available Dial gauge
	4	795-111-1160 Extension rod

1. Setting standard value of fuel injection timing

- 1) Check and record the fuel injection timing No. of the fuel injection pump indicated on boss (2) on the engine side of fuel injection pump housing (1). Consider that there is a decimal point in the injection timing value. For example, handle 68 as 6.8.



- 2) Check the FIR (Fuel Injection Reference) No. of the engine to be tested and adjusted.

FIR No.:

3.5 (PC27MR-3 [3D82AE-6 engine])

5.0 (PC30/35MR-3 [3D88E-6 engine])

- 3) Calculate the fuel injection timing angle.
 - The FIR No. depends on the engine model No.
 - The engine model is stamped on the engine nameplate.
 - Substitute the injection timing No. on the side of the fuel injection and the FIR No. in the following calculation formula.

(Fuel injection pump injection timing No. x 2) + FIR No. = Fuel injection timing angle

★ Example of engine model No. 3D82AE-6 having injection timing No. "68"

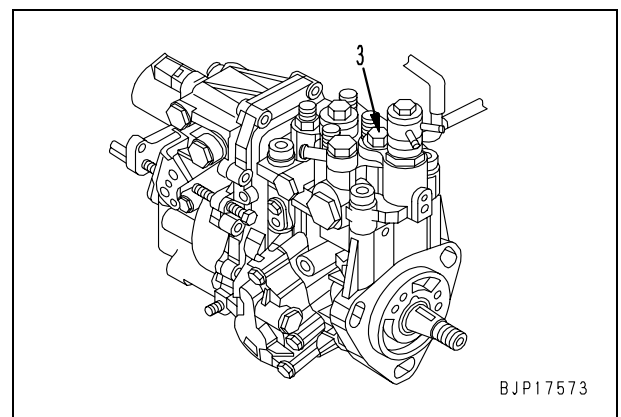
$$(6.8 \times 2) + 3.5 = 13.6 + 3.5 = 17.1^\circ$$

(Fuel injection timing angle)

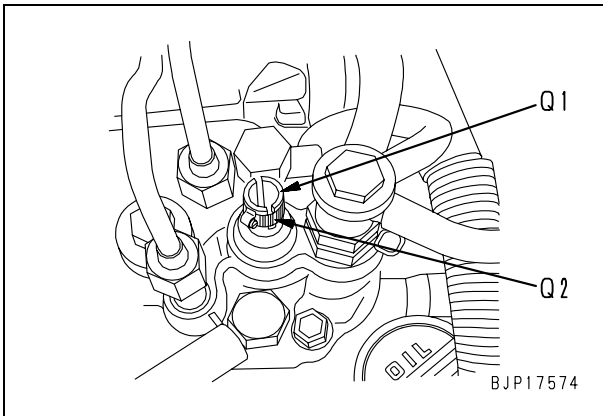
2. Testing fuel injection timing

- ★ Some fuel may leak from the fuel injection pump during the following work. Prepare a container to receive the leaking fuel before starting the work.

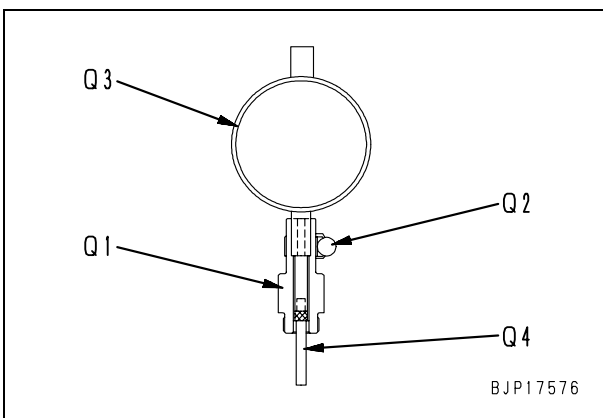
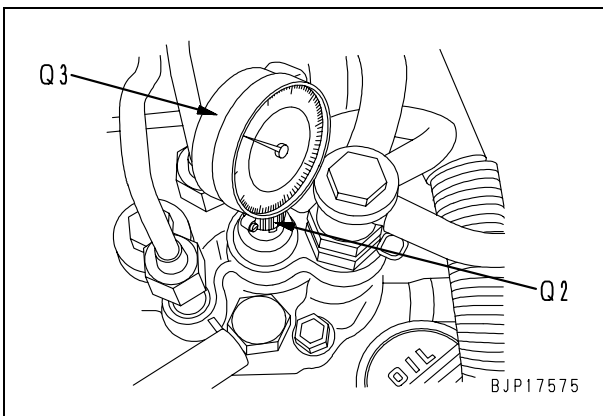
- 1) Close the fuel tank valve.
- 2) Close the water separator handle.
- 3) Clean the top of the fuel injection pump so that dirt will not enter when the plunger plug of the fuel injection pump is removed.
- 4) Remove fuel injection pump plunger plug (3) on the top front side of the fuel injection pump.



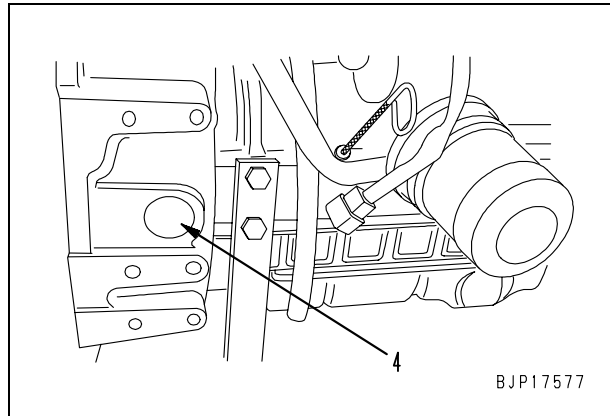
- 5) Install dial indicator adapter **Q1** to the opening of the fuel injection pump plunger and set clamp **Q2** to **Q1**.



- 6) Set extension rod **Q4** to dial gauge **Q3** and install dial gauge **Q3** to adapter **Q1**.
★ Secure dial gauge **Q3** to about the center of the moving range with plunger adapter clamp **Q2**.

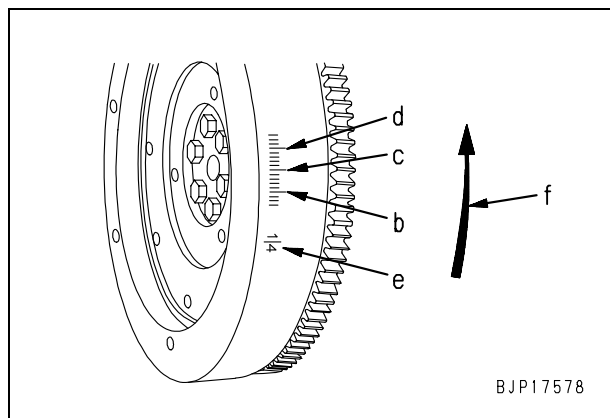


- 7) Put a wrench on the crankshaft pulley mounting bolt and rotate the crankshaft clockwise, seeing from the gear case side, until the injection timing mark on the flywheel side is seen through inspection window (4) of the flywheel.



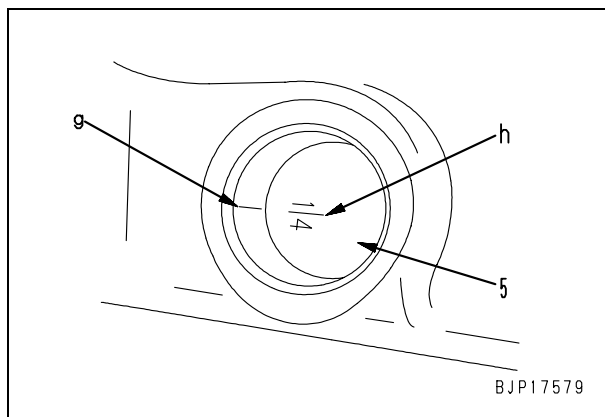
- 8) The marks on the flywheel are usually arranged as shown in the following figure.
b : 10° BTDC
(Before Top Dead Center)
c : 15° BTDC
d : 20° BTDC
e : TDC (Top Dead Center)
f : Rotating direction
★ The TDC (Top Dead Center) mark can be identified by the cylinder No. stamped near the TDC mark of the flywheel.

- Example of 4-cylinder engine

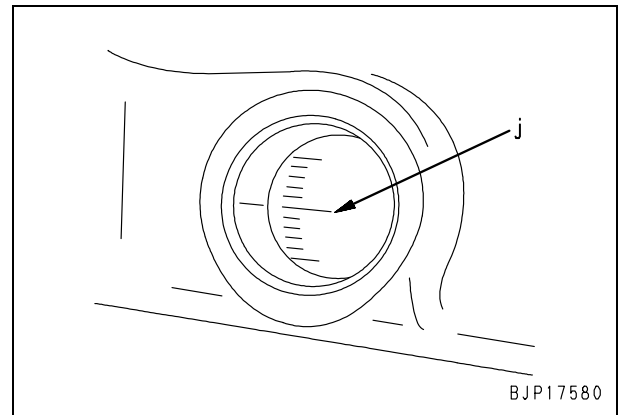


- ★ If the timing scale angle on the flywheel is clear, the timing angle can be obtained by measuring the timing scale.
- First, measure the distance between the 2 long divisions (5° apart from each other). Next, measure the distance between the TDC mark and the long division nearest to the TDC mark. Divide this value with the distance between the 2 long divisions. From the division result, you can obtain the angle between the TDC mark and the division nearest to it.
- Example:
If the distance between the 2 long divisions is about 2.0 cm and the distance between the TDC mark and the long division near to it is about 4.0 cm, the division result is about 2. From this, the angle between the TDC mark and the long division near to it is 10° (2 × 5°). As a result, it is seen that the 1st long division shows 10° BTDC, the 2nd long division 15° BTDC, and 3rd long division 20° BTDC. If the division result is 3, the angle between the TDC mark and the first long division is 15° (3 × 5°), and the 1st long division shows 15° BTDC, the 2nd long division 20° BTDC, and 3rd long division 25° BTDC.

- 9) Check the timing datum mark (g) of the flywheel housing and the TDC (Top Dead Center) mark (h) stamped on flywheel (5).



- 10) Check timing mark (j) to be adjusted on the flywheel side according to the calculation result of "Setting standard value of fuel injection timing".



- 11) Rotate the crankshaft counterclockwise until the dial indicator indicates that the fuel injection pump plunger is at the lowest position of the moving stroke. Rotate the crankshaft a little to the right and left and find a point where the dial indicator does not move at all and then set the dial indicator to zero.
- 12) Rotate the crankshaft counterclockwise slowly until the dial indicator indicates that the fuel injection pump plunger is raised by 2.5 mm.
- 13) See where timing mark (j) to be set on the flywheel side (determined by the above procedure) is for timing datum mark (g) of the flywheel housing. If timing mark (j) is at the target timing division mark, the fuel injection timing is proper. If not, adjust according to "Adjusting fuel injection timing".
- 14) If the injection timing is proper, remove the dial indicator and adapter and return the removed parts.

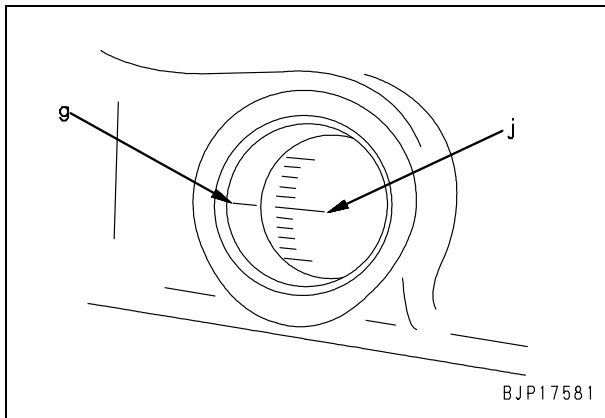
⌘ Plunger plug:

30 – 35 Nm {3.1 – 3.6 kgm}

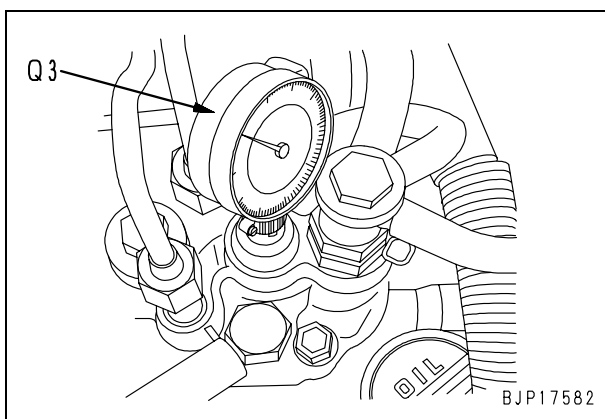
3. Adjusting fuel injection timing

As a result of "Testing fuel injection timing", if the timing mark is not set properly, adjust it according to the following procedure to correct the fuel injection timing.

- 1) Keep the dial indicator installed to the fuel injection pump and take care that the pointer of the dial gauge will not move.
- 2) Rotate the flywheel until timing mark (j) to be set is matched to timing datum mark (g) of the flywheel.
 - ★ Do not rotate the crankshaft during the following procedure.



- 3) Check the value indicated by dial gauge **Q3**.
 - If the indicated value is less than 2.5 mm, the fuel injection timing is delayed.
 - If the indicated value is 2.5 mm or larger, the fuel injection timing is advanced.

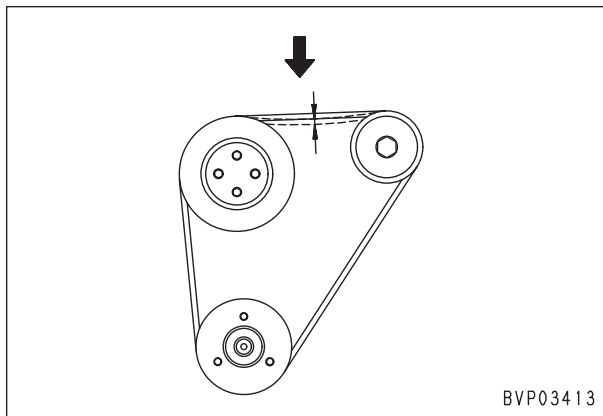


- 4) Loosen the 3 nuts securing the fuel injection pump to the gear case or front plate and the rear bracket of the fuel injection pump.
 - ★ If the fuel high-pressure pipe nuts of the fuel injection pump are loosened, the pump can be rotated easily.
- 5) Rotate the fuel injection pump until the dial gauge indicates 2.5 mm.
 - To "advance" the fuel injection timing, rotate the fuel injection pump and bring its top away from the engine.
 - To "delay" the fuel injection timing, rotate the fuel injection pump and bring its top near the engine.
- 6) If the timing mark to be set on the flywheel is matched to the datum mark on the flywheel housing or engine back plate while the dial gauge is indicating that the lift of the fuel injection pump plunger is 2.5 mm, the fuel injection timing is proper.
- 7) Tighten the fuel injection pump mounting nuts and rear bracket.
 - ⌘ Fuel injection pump mounting nut:
23 – 28 Nm {2.3 – 2.9 kgm}
 - ⌘ Fuel high-pressure pipe nut:
29 – 34 Nm {3.0 – 3.5 kgm}
- 8) Remove the dial gauge and adapter and return the removed parts.
 - ⌘ Plunger plug:
30 – 35 Nm {3.1 – 3.6 kgm}

Testing and adjusting alternator belt tension

Testing

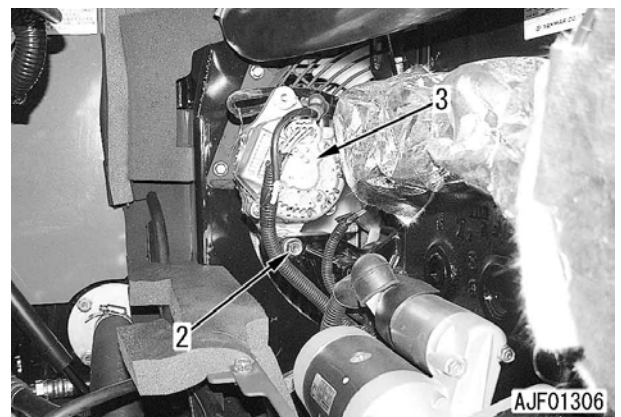
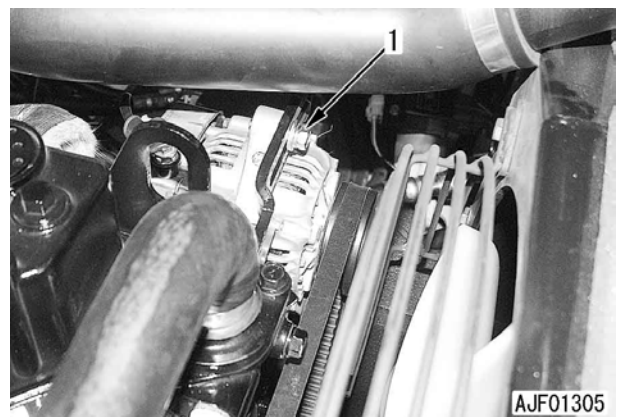
1. Tilt up the floor frame.
For details, see "How to open and close (tilt) floor".
2. Press the intermediate point between the alternator pulley and fan pulley with a force of about 98 N {10 kg}. If the belt deflection at this time is 7 – 10 mm, the belt tension is normal.



Adjusting

★ If the belt deflection is not normal, adjust it according to the following procedure.

1. Loosen belt tension adjustment bolt (1) and alternator mounting nut (2).
2. Using a bar, move alternator (3) toward the front of the machine and tighten belt tension adjustment bolt (1).
3. Tighten alternator mounting nut (2).
4. Check the belt tension again.

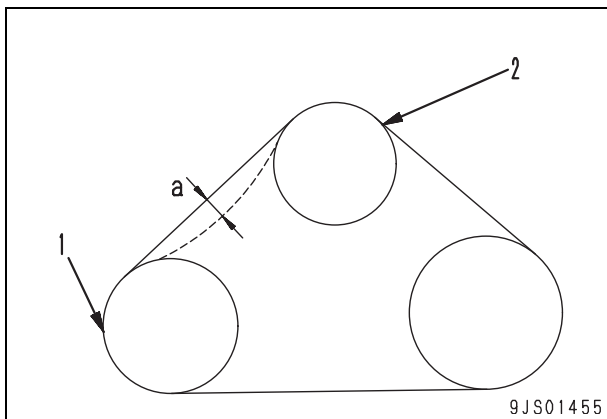


5. After finishing adjustment, tilt down the floor frame.
For details, see "How to open and close (tilt) floor".

Testing and adjusting air conditioner compressor belt tension

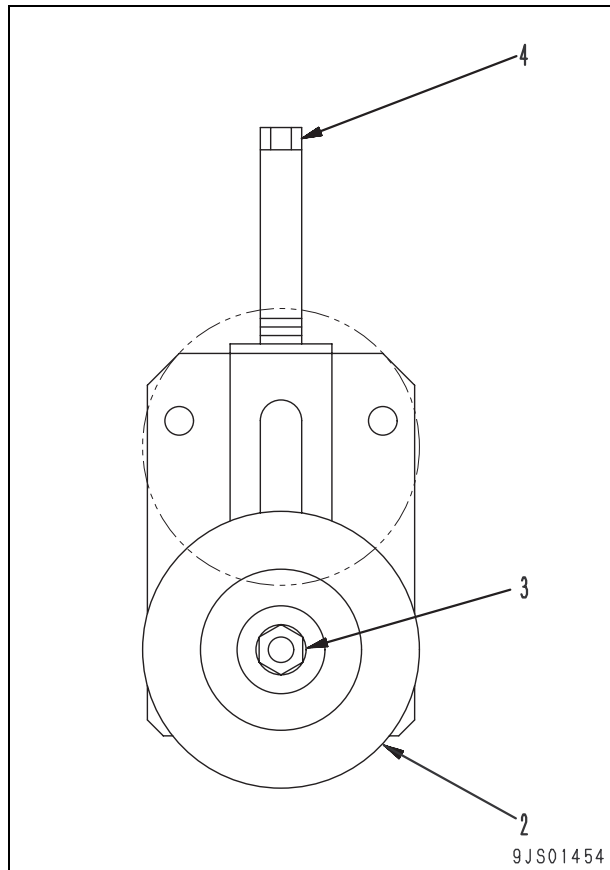
Testing

1. Open the engine side cover.
2. Press the intermediate point of the belt between compressor pulley (1) and idler pulley (2) with a finger and measure deflection (a) of the belt.
 - Force to press belt: Approx. 58.8 N {6 kg}
 - Deflection: 5 – 6 mm



Adjusting

- ★ If the deflection of the belt is abnormal, adjust it according to the following procedure.
1. Loosen nut (3) of idler pulley (2).
 2. Adjust the belt tension with adjustment nut (4).
 3. Tighten nut (3).



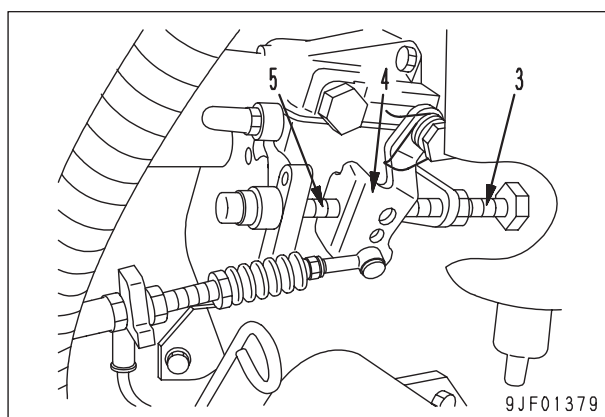
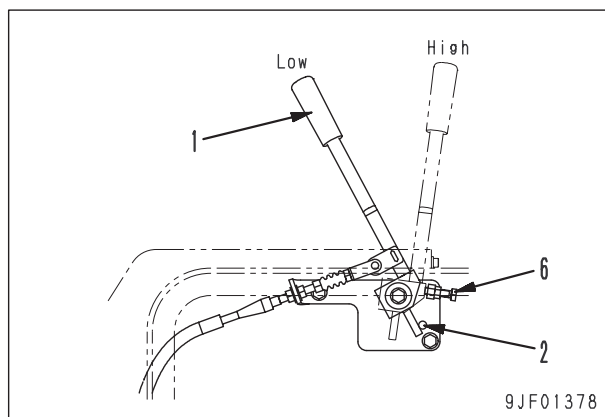
Adjusting fuel control lever

1. Adjusting low idle

- 1) Lean fuel control lever (1) forward until it touches stopper (2) on the low idle side.
- 2) Turn low idle adjustment screw (3) on the injection pump side so that low idle is set to the specified speed.

2. Adjusting high idle

- 1) Lean fuel control lever (1) backward until injection pump lever (4) touches stopper bolt (5) on the high idle side.
- 2) Under the above condition, bring stopper bolt (6) in contact with fuel control lever (1), then return it by 1/2 turn and secure it with the locknut.
 - ★ The screw on the high idle side of the injection pump cannot be adjusted. . Accordingly, if the high idle speed is still low when stopper bolt (5) on the high idle side touches the governor lever of the injection pump, test the injection nozzle, etc.



Testing clearance in swing circle bearings

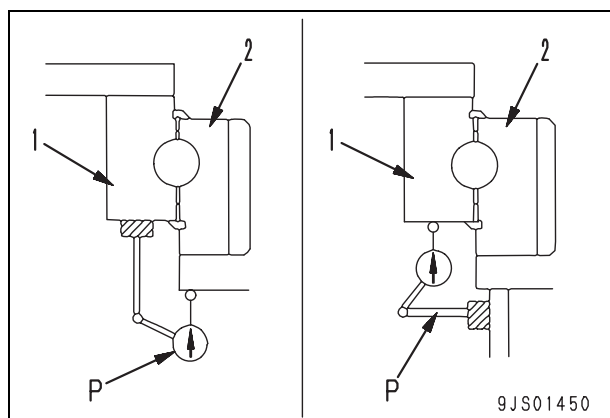
- ★ Measuring instruments for swing circle bearing clearance

Symbol	Part No.	Part Name
P	Commercially available	Dial gauge

- ★ Follow the steps explained below, when measuring clearance in the swing circle bearing in the actual machine.

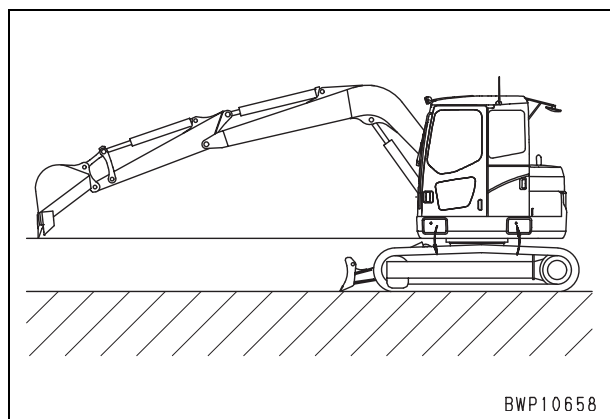
⚠ **Be careful not to put a hand or foot under the track shoe, while taking measurement.**

1. Fasten dial gauge **P** to swing circle outer race (1) or inner race (2), and contact the probe with the end surface of inner race (2) or outer race (1) on the opposite side.
★ Set dial gauge **P** at the machine front or rear.

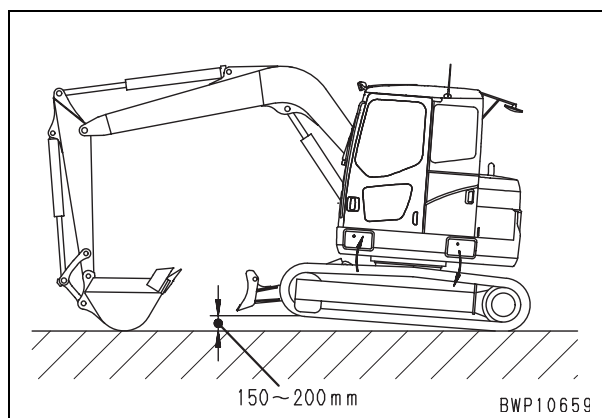


2. Keep the work equipment in the max. reach posture and keep the height of the bucket teeth tip level with the lower height of the revolving frame.

3. Set dial gauge **P** at zero point.



4. Hold the arm nearly perpendicular to the ground, and lower the boom until the track shoes will be lifted at the machine front.
★ The upper structure is raised at the front and lowered at the rear at that time.
5. Read off the value in dial gauge **P** in this condition.
★ The value indicated in dial gauge **P** expresses clearance in the bearings.

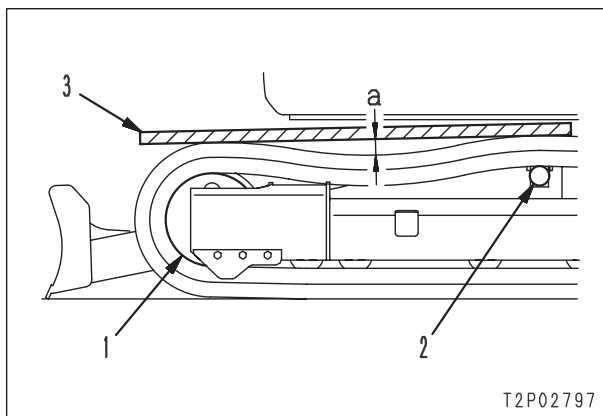


6. Return the machine to the posture in Item 2 above, and confirm reading of dial gauge **P** is zero.
★ If zero value is not indicated, repeat the steps in Items 3 through 5.

Testing and adjusting track shoe tension

Testing

1. Run the engine at low idle and move the machine by the length of track on ground, then stop slowly.
2. Place wood block (3) on the track shoe between idler (1) and carrier roller (2).
3. Measure maximum slack (a) between the top of the track shoe and wood block (3).
 - Standard slack (a):
 - Rubber shoe: 1 – 3 mm
 - Road liner, steel shoe: 10 – 30 mm



Adjusting

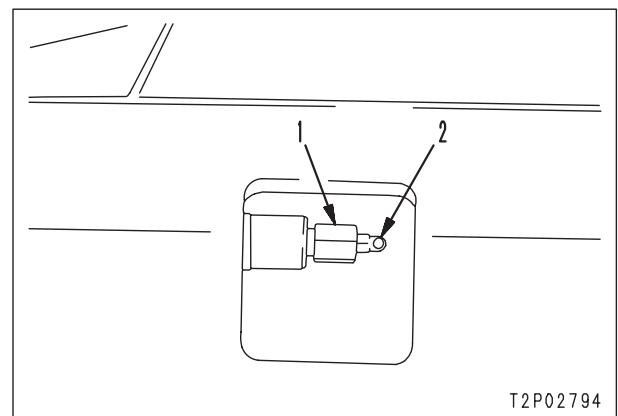
- ★ If the track shoe tension is abnormal, adjust it according to the following procedure.

1. When tension is too high

- 1) Loosen valve (1) and discharge grease.
 - ⚠ **Do not loosen the valve more than 1 turn. If it is loosened more, it may jump out because of the high-pressure grease in it.**
 - ★ If the grease does not flow out, move the machine slowly forward and in reverse.
- 2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
- 3) Test the track shoe tension again. If it is abnormal, adjust it again.

2. When tension is low

- 1) Supply grease through grease fitting (2).
 - ★ If the shoe is not tensed properly, move the machine slowly forward and in reverse.
 - 🔧 Grease fitting: **Grease (G2-LI)**
- 2) To check that the tension is normal, run the engine at low idle and move the machine forward by the length of track on ground, then stop slowly.
- 3) Test the track shoe tension again. If it is abnormal, adjust it again.



Testing and adjusting oil pressures in work equipment, travel, boom swing, swing, and blade circuits

- ★ Measuring instruments for oil pressures in work equipment, travel, boom swing, swing, and blade circuits

Symbol	Part No.	Part Name
G	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-101-5220 Nipple
		07002-11023 O-ring

Measuring

- ★ Hydraulic oil temperature for measurement:
45 – 55°C

⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank and set the work equipment lock lever in the LOCK position.

- ★ Remove the triangular cover from the left rear of the machine.

1. Measuring oil pressures in work equipment, travel, and boom swing circuits

- 1) Remove main pump circuit oil pressure pickup plug (1).

- ★ You may remove either plug from PC35MR-3.

PC27MR-3, PC30MR-3

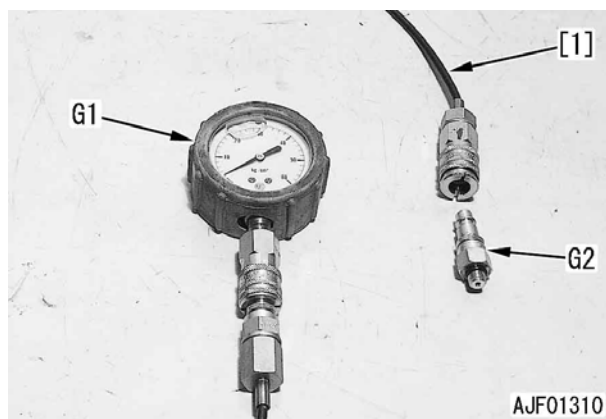
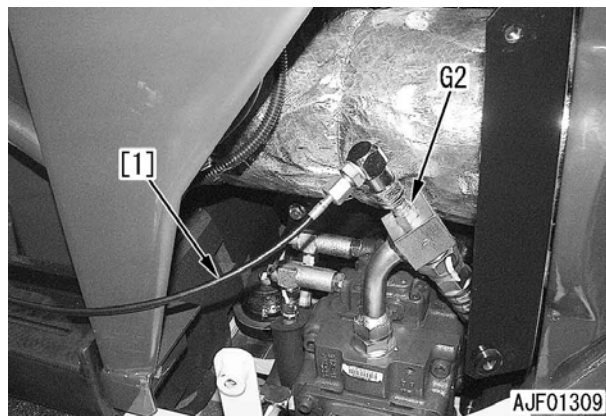


PC35MR-3



- 2) Install nipple **G2** and connect oil pressure gauge **G1** (40 MPa {400 kg/cm²}) by hose [1].

Example of PC30MR-3



3) Measuring relief pressure

Start the engine, operate the actuator of the circuit to be measured, and measure the relief pressure.

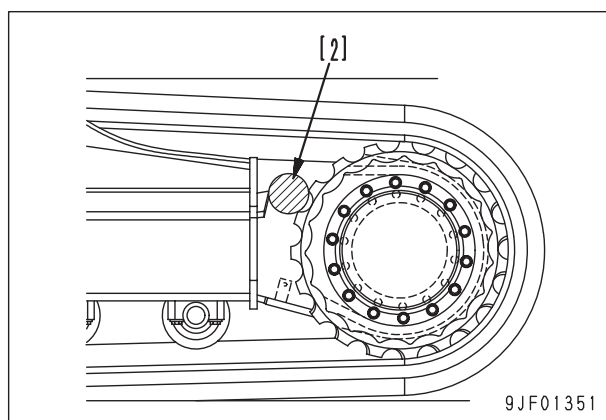
- Set the actuator to be measured as explained below.

1) Work equipment and boom swing:
Set each cylinder to the stroke end.

2) Travel:
Put block [2] between the sprocket and track frame to lock the travel motor.

4) Measuring unload oil pressure

Set all the control levers in neutral, run engine at full throttle, and measure the oil pressure.



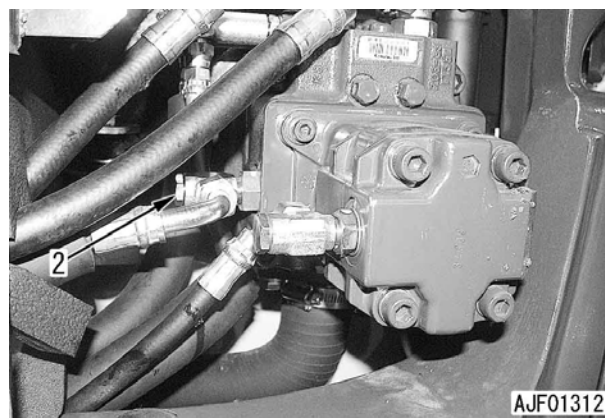
2. Measuring oil pressures in swing and blade circuits

- 1) Remove the swing and blade circuit oil pressure pickup plug (2).

PC27MR-3, PC30MR-3

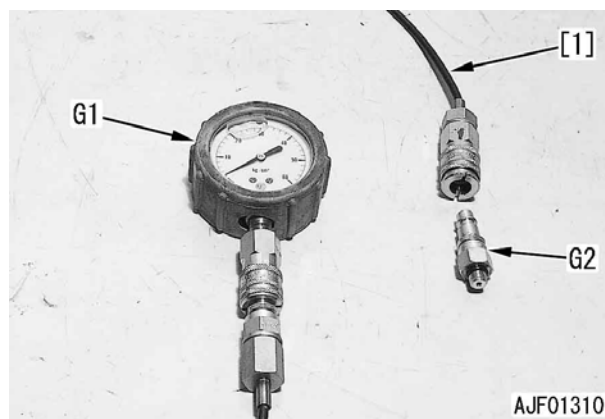
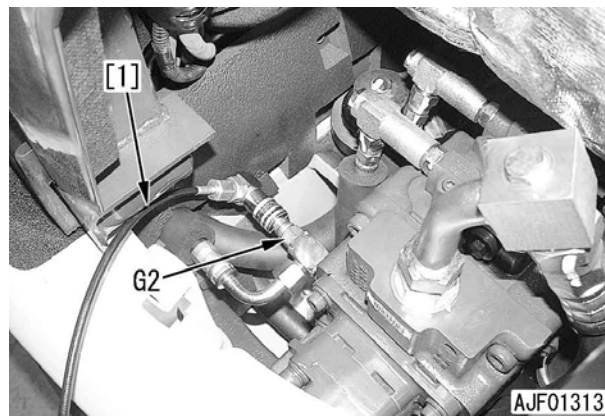


PC35MR-3



- 2) Install nipple **G2** and connect oil pressure gauge **G1** (40 MPa {400 kg/cm²}) by hose [1].

Example of PC30MR-3



- 3) Start the engine, operate the actuator of the circuit to be measured, and measure the relief pressure.

- Set the actuator to be measured as explained below.

- 1] Blade:

Set the cylinder to the stroke end.

- 2] Swing:

Lock the swing motor.

⚠ Since a swing holding brake is not installed, lock the machine securely with the work equipment.

- ★ The set pressure of the safety valve of the swing motor is lower than that of the main relief valve. Accordingly, if the swing circuit is relieved, the set pressure of the safety valve is obtained.

Adjusting

- ★ If any of the oil pressures in the work equipment, travel, boom swing, swing, and blade circuits is abnormal, adjust the corresponding valve according to the following procedure.

- ★ The unload valve cannot be adjusted.

- ★ Tilt up the floor frame.

For details, see "How to open and close (tilt) floor".

1. Adjusting main relief valves of work equipment, travel, and boom swing circuits

- **Applicable model: PC27MR-3, PC30MR-3**

- 1) Loosen locknut (2) of main relief valve (1) and turn adjustment screw (3).

- ★ If the adjustment screw is

- Turned to the right, the pressure is increased.
- Turned to the left, the pressure is decreased.

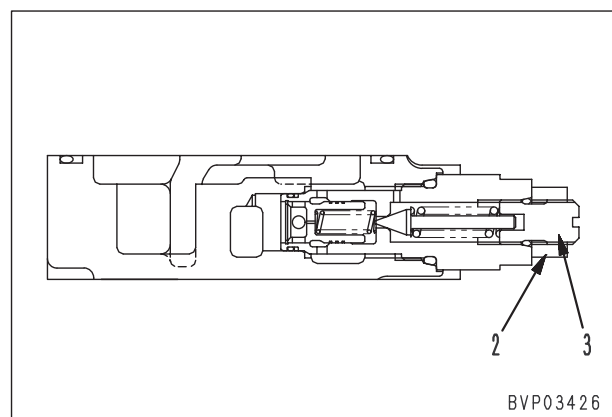
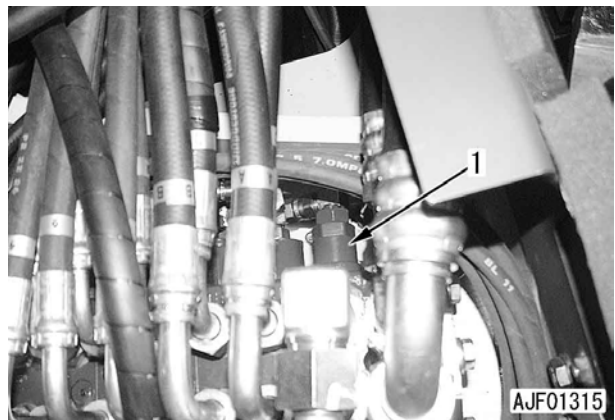
- ★ Amount of adjustment per turn of adjustment screw:

12.6 MPa {128 kg/cm²}

- 2) After adjusting, tighten locknut (2).

⌘ Locknut: **59 – 79 Nm {6 – 8 kgm}**

- 3) Referring to the section of measuring, check the relief pressure again.

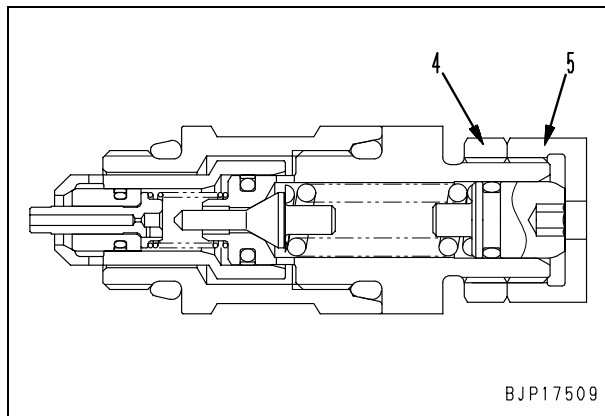


- **Applicable model: PC35MR-3**

- 1) Loosen locknut (4) of main relief valve (6) and turn adjustment nut (5).
 - ★ If the adjustment screw is
 - Turned to the right, the pressure is increased.
 - Turned to the left, the pressure is decreased.
 - ★ Amount of adjustment per turn of adjustment screw:

19.6 MPa {200 kg/cm²}

- 2) After adjusting, tighten locknut (4).
 ☞ Locknut: **39 – 49 Nm {4 – 5 kgm}**
- 3) Referring to the section of measuring, check the relief pressure again.



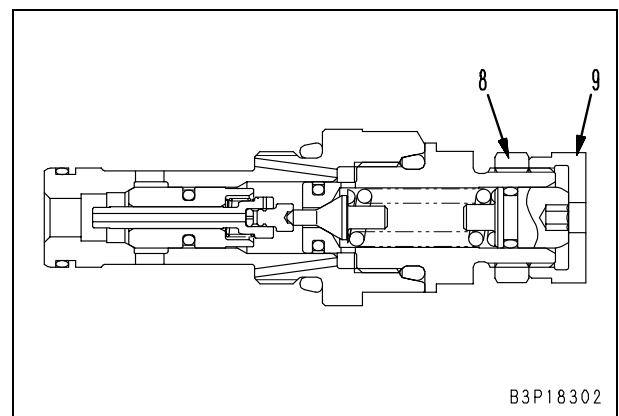
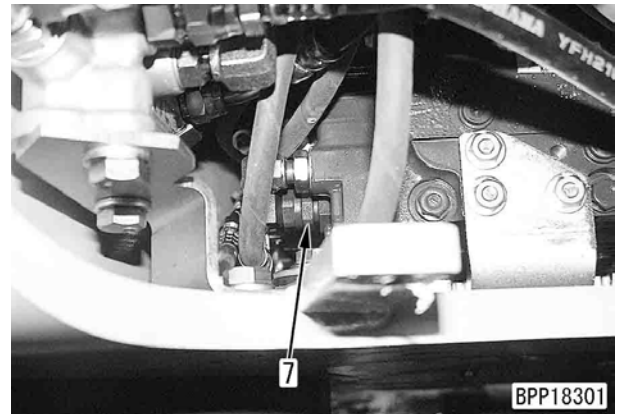
2. Adjusting main relief valves of swing and blade circuits

- ★ The set pressure of the safety valve of the swing motor is lower than that of the main relief valve. Accordingly, the relief pressure of only the blade circuit is obtained.

- 1) Loosen locknut (8) of relief valve (7) and turn adjustment nut (9).
 - ★ If the adjustment screw is
 - Turned to the right, the pressure is increased.
 - Turned to the left, the pressure is decreased.
 - ★ Amount of adjustment per turn of adjustment screw:

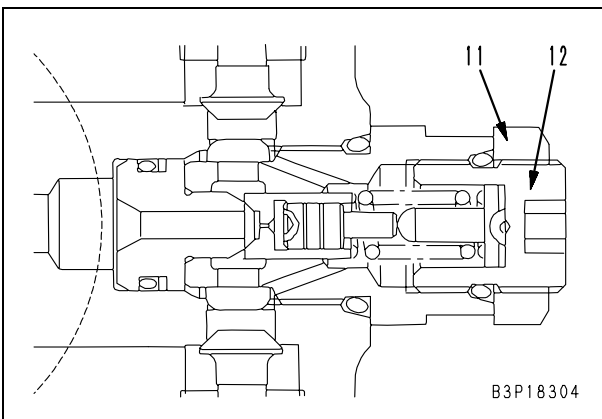
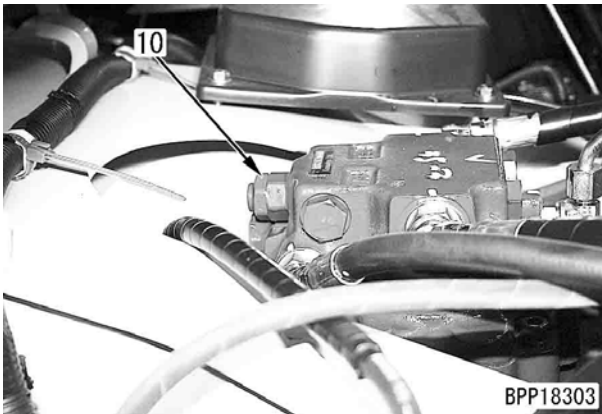
19.6 MPa {200 kg/cm²}

- 2) After adjusting, tighten locknut (8).
 ☞ Locknut: **39 – 49 Nm {4 – 5 kgm}**
- 3) Referring to the section of measuring, check the relief pressure again.



3. Adjusting safety valve of swing motor

- ★ If the swing relief pressure is abnormal, adjust the swing motor safety valve according to the following procedure.
- 1) Loosen locknut (11) of swing motor safety valve (10) and turn adjustment screw (12).
 - ★ If the adjustment screw is
 - Turned to the right, the pressure is increased.
 - Turned to the left, the pressure is decreased.
 - ★ Amount of adjustment per turn of adjustment screw:
17.54 MPa {179 kg/cm²}
- 2) After adjusting, tighten locknut (11).
 - ☞ Locknut:
78.4 – 102.9 Nm {8 – 10.5 kgm}
- 3) Referring to the section of measuring, check the relief pressure again.



Testing and adjusting LS differential pressure

- ★ Measuring instruments for LS differential pressure

Symbol	Part No.	Part Name
H	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-101-5220 Nipple
		07002-11023 O-ring
	3	799-401-2701 Differential pressure gauge
	4	799-401-3100 Adapter
		02896-11008 O-ring
	5	799-401-3200 Adapter
		02896-11009 O-ring

Measuring

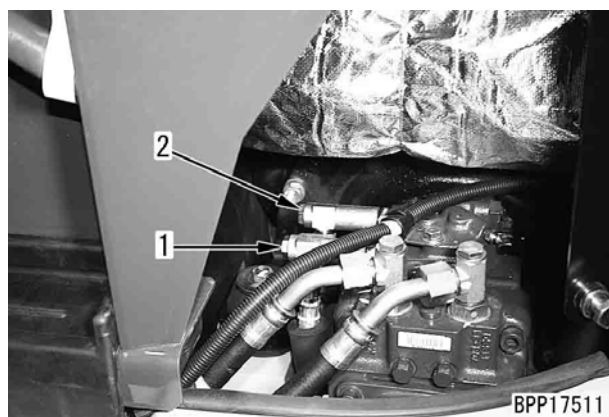
- ★ Remove the triangular cover from the left rear of the machine.

Measuring with differential pressure gauge

1. Remove oil pressure pickup plugs (1) and (2).
PC27MR-3, PC30MR-3



PC35MR-3

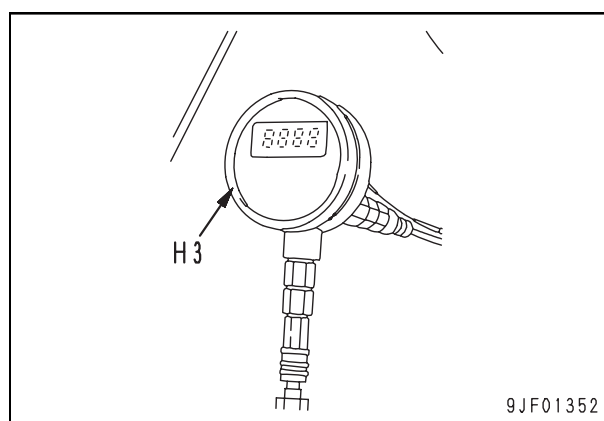
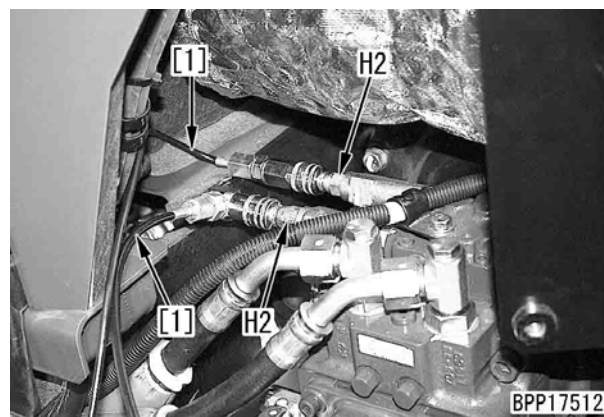


PC27MR-3, PC30MR-3, PC35MR-3

2. Install nipple **H2** and connect differential pressure gauge **H3** by hose [1].
★ Connect pump discharge pressure side (1) to the high pressure side of the differential pressure gauge and connect LS pressure side (2) to the low pressure side.
3. Run the engine at full throttle and measure the LS differential pressure under the following condition.
★ If the LS differential pressure is as follows, it is normal.

Operation of lever	LS differential pressure
Set all levers in neutral	Unload pressure (See standard service values table)
Curl bucket (Move bucket lever to stroke end)	Specified LS differential pressure (See standard service values table)

Example of PC35MR-3



Measuring with oil pressure gauge

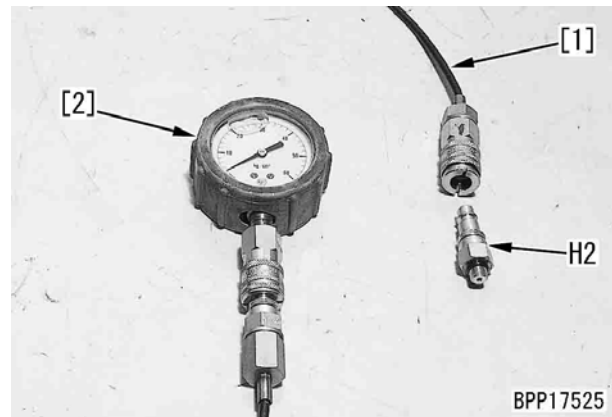
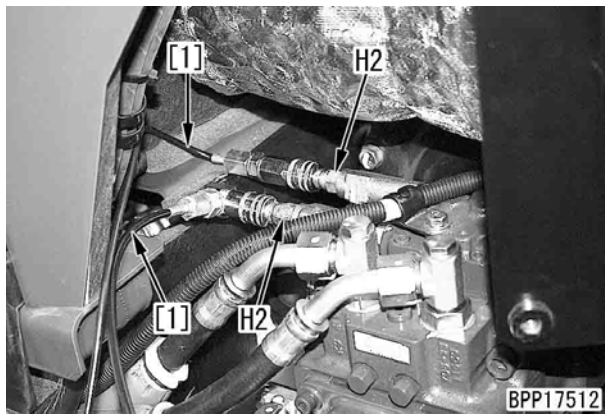
- ★ Since the differential pressure is 1.96 MPa {20 kg/cm²} at maximum, measure it with the same oil pressure gauges.

1. Remove oil pressure pickup plugs (1) and (2).

PC27MR-3, PC30MR-3**PC35MR-3**

2. Install nipple **H2** and connect oil pressure gauge [2] (40 MPa {400 kg/cm²}) of **H1** by hose [1].

- ★ Use oil pressure gauges having minimum divisions of 1 MPa {10 kg/cm²}.

Example of PC35MR-3

3. Run the engine at full throttle and measure the pump discharge pressure under the condition for measuring with the differential pressure gauge.

- ★ Read the gauge pointer accurately from the front side of the gauge.


4. Run the engine at full throttle and measure the LS pressure under the condition for measuring with the differential pressure gauge.

- ★ Read the gauge pointer accurately from the front side of the gauge.

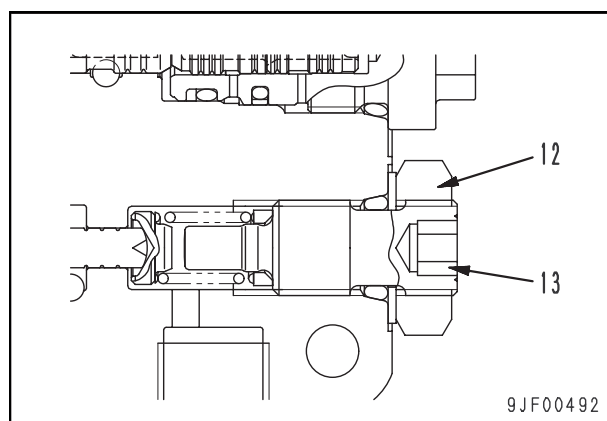
5. Calculate the LS differential pressure from the pump discharge pressure and LS pressure.

- ★ LS differential pressure = Pump discharge pressure – LS pressure

Adjusting

- ★ If the LS differential pressure is abnormal, adjust the LS valve according to the above procedure.
- 1. Loosen locknut (12) of LS valve (11) and turn adjustment screw (13).
 - ★ If the adjustment screw is
 - Turned to the right, the pressure is increased.
 - Turned to the left, the pressure is decreased.
- 2. After adjusting, tighten locknut (12).
 Locknut:
27.4 – 34.3 Nm {2.8 – 3.5 kgm}
- 3. Referring to the section of measuring, check the LS differential pressure again.

Example of PC35MR-3



Adjusting PC valve

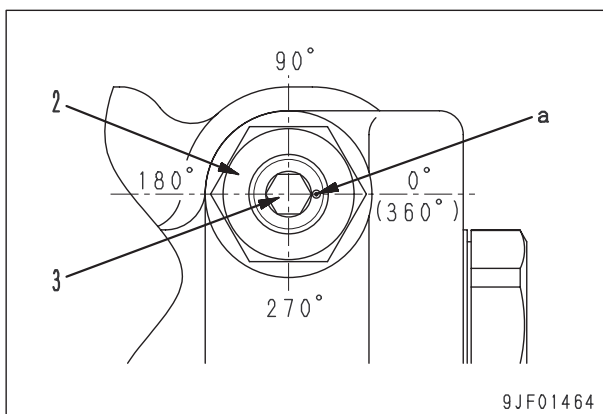
- ★ While the pump discharge pressure and LS differential pressure are normal, if the following faults occur, adjust the PC valve.
 - When the load is increased, the engine speed lowers.
 - The engine speed is normal but the work equipment speed is low.
1. Loosen locknut (2) of PC valve (1) and turn adjustment screw (3).
 - ★ Before loosening locknut (2), be sure to make match mark "a".
 - ★ The PC valve is eccentric and it is uncertain in which direction the absorption torque is rotated to increase. Accordingly, adjust while monitoring the engine speed.

2. After adjusting, tighten locknut (2).

🔧 Locknut:

27.4 – 34.4 Nm {2.8 – 3.5 kgm}

Example of PC27-3



Testing and adjusting control pump circuit oil pressure

Applicable model: PC35MR-3

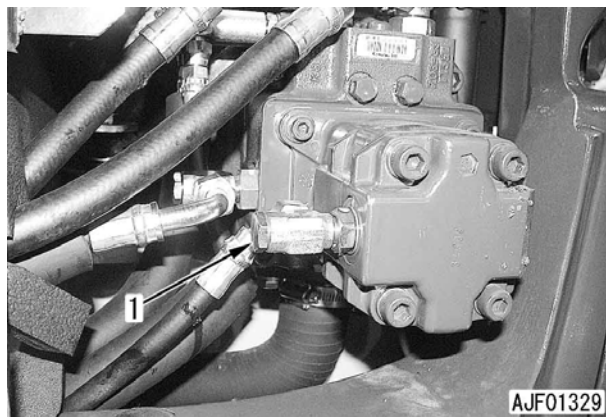
- ★ Measuring instruments for control pump circuit oil pressure

Symbol	Part No.	Part Name
K	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-101-5220 Nipple
		07002-11023 O-ring

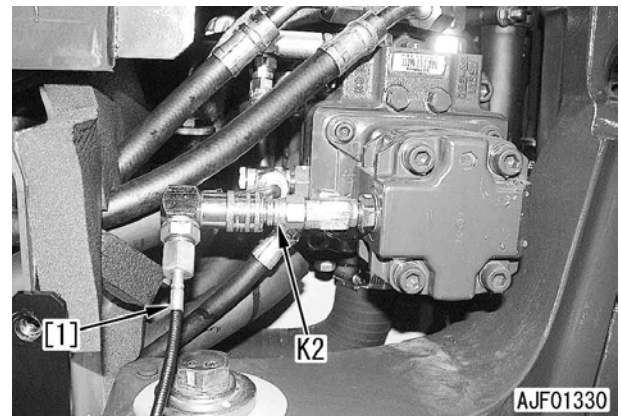
Measuring

- ★ Hydraulic oil temperature for measurement:
45 – 55°C
- ★ Remove the triangular cover from the left rear of the machine.

1. Remove oil pressure pickup plug (1) of the control pump outlet hose.



2. Install nipple **K2** and connect hose [1] to oil pressure gauge **K1** (6 MPa {60 kg/cm²}).
3. Run the engine at full throttle, set the control lever in neutral, and measure the circuit oil pressure.

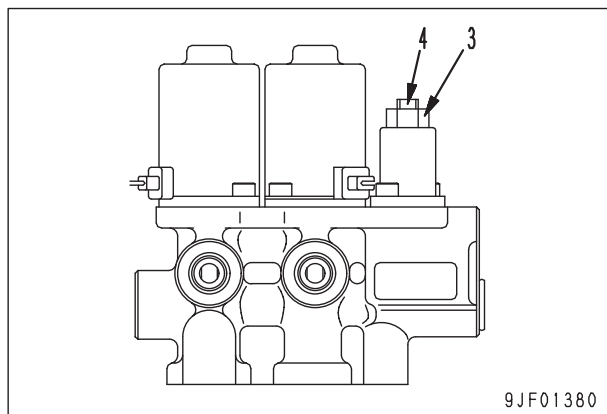


Adjusting

- ★ If the control circuit oil pressure is abnormal, adjust control relief valve according to the following procedure.
- ★ Tilt up the floor frame.
For details, see "How to open and close (tilt) floor".

1. Loosen locknut (3) of relief valve (2) and turn adjustment screw (4).
 - ★ If the adjustment screw is
 - Turned to the right, the pressure is increased.
 - Turned to the left, the pressure is decreased.
 - ★ Amount of adjustment per turn of adjustment screw: **0.92 MPa {9.4 kg/cm²}**
2. After adjusting, tighten locknut (3).
 ☞ Locknut: **9.8 Nm {1.0 kgm}**





3. Tilt down the floor frame.
For details, see “How to open and close (tilt) floor”.
4. Referring to the section of measuring, check the pressure again.

Testing solenoid valve output pressure

- ★ Measuring instruments for solenoid valve output pressure

Symbol	Part No.	Part Name
L	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-401-3100 Adapter
		02896-11008 O-ring

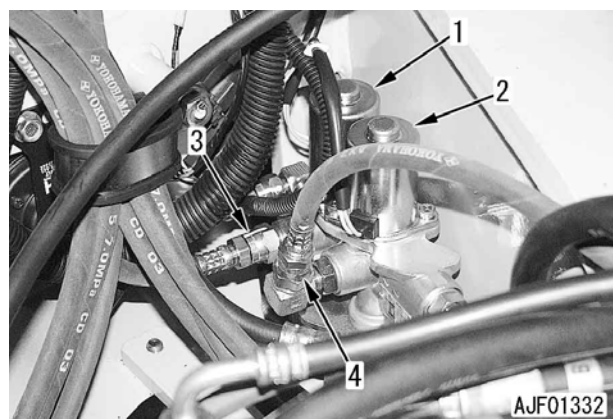
Measuring

- ★ Hydraulic oil temperature for measurement: 45 – 55°C
- ★ Measure the pressure at the outlet of each solenoid valve.

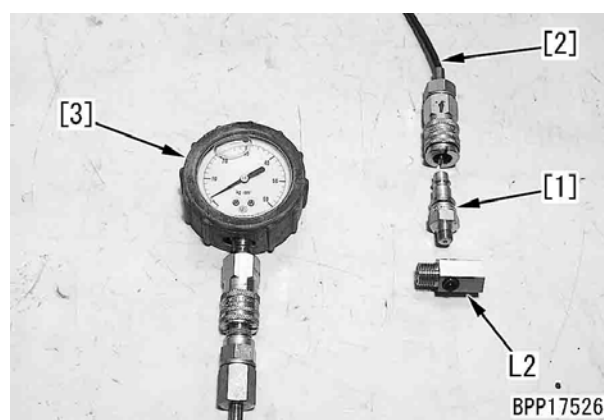
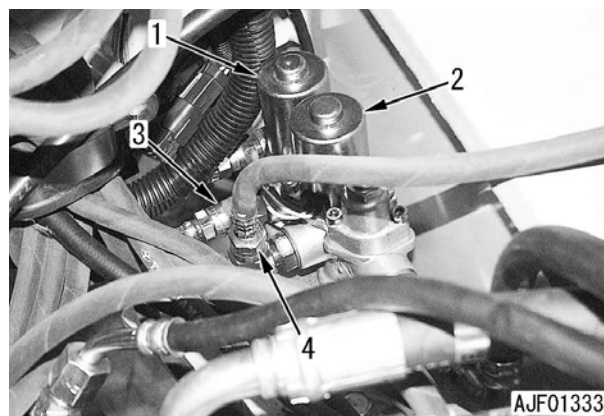
No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	2nd travel speed selection solenoid valve

1. Tilt up the floor frame.
For details, see “How to open and close (tilt) floor”.
2. Disconnect outlet hose (3) or (4) of the solenoid valve to be measured and install adapter **L2**, then install nipple [1] of oil pressure gauge kit **L1** to adapter **L2**.
★ Hose (3) is on the PPC lock solenoid side and (4) is on 2nd travel speed selection solenoid side.
3. Connect oil pressure gauge [3] (6 MPa {60 kg/cm²}) by hydraulic hose [2].

PC27MR-3, PC30MR-3



PC35MR-3



4. Tilt down the floor frame.
For details, see “How to open and close (tilt) floor”.
5. Run the engine at full throttle and measure the output pressure under the following conditions.

No.	Solenoid valve	Measurement conditions	Operation of solenoid	Oil pressure (MPa{kg/cm ² })
1	PPC lock	Lock lever: LOCK	OFF	0{0}
		Lock lever: FREE	ON	2.94 ^{+0.49} _{-0.1} {30 ⁺⁵ ₋₁ }
2	2nd travel speed selection	2nd travel speed selection pedal: OFF	OFF	0{0}
		2nd travel speed selection pedal: ON	ON	2.94 ^{+0.49} _{-0.1} {30 ⁺⁵ ₋₁ }

Testing PPC valve output pressure

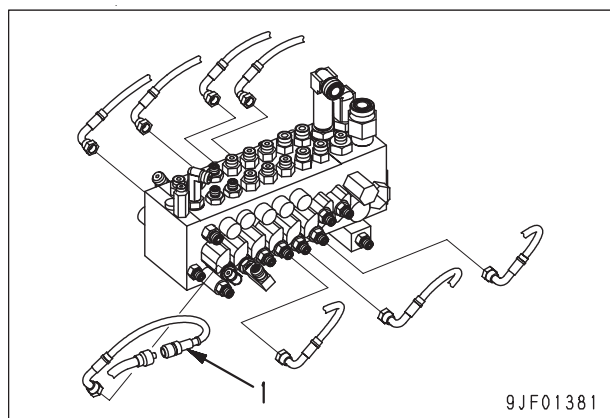
- ★ Measuring instruments for PPC valve output pressure

Symbol	Part No.	Part Name
M	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-401-3100 Adapter
		02896-11008 O-ring

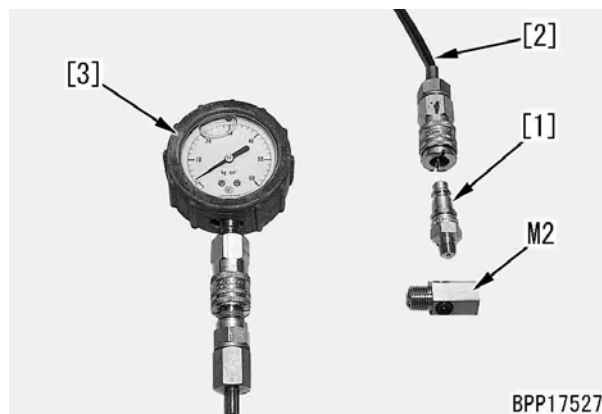
Measuring

- ★ Measure the PPC valve output pressure when the work equipment speed or swing speed is low or the work equipment does not move.
- ★ Hydraulic oil temperature for measurement:
45 – 55°C

1. Tilt up the floor frame.
For details, see “How to open and close (tilt) floor”.
2. Disconnect PPC hose (1) of the circuit to be measured from the PPC valve or control valve, install adapter **M2**, and install nipple [1] of oil pressure gauge kit **M1**.
★ The connection diagram of the PPC valve and control valve is shown on the next page.



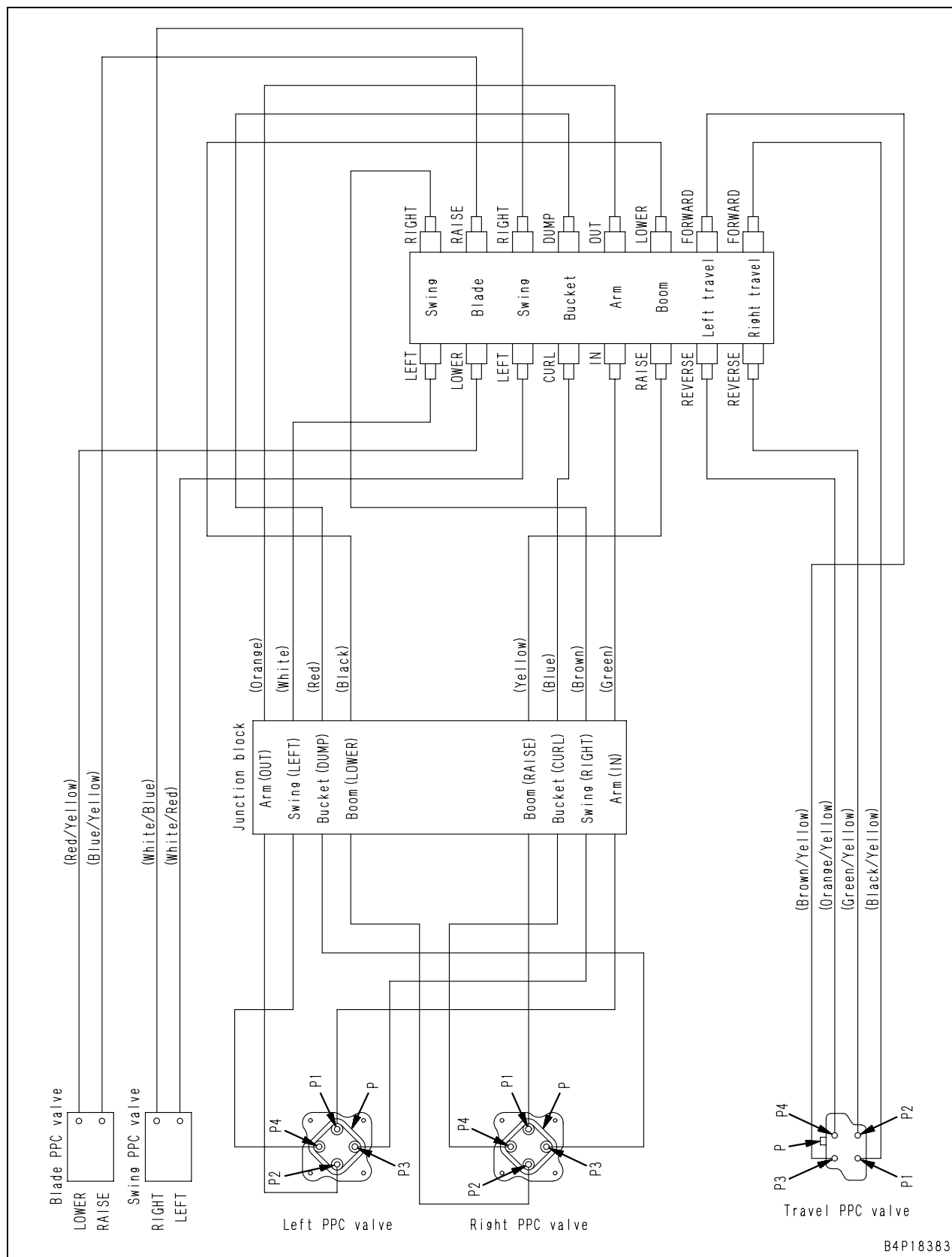
3. Connect oil pressure gauge [3] (6 MPa {60 kg/cm²}) by hydraulic hose [2].



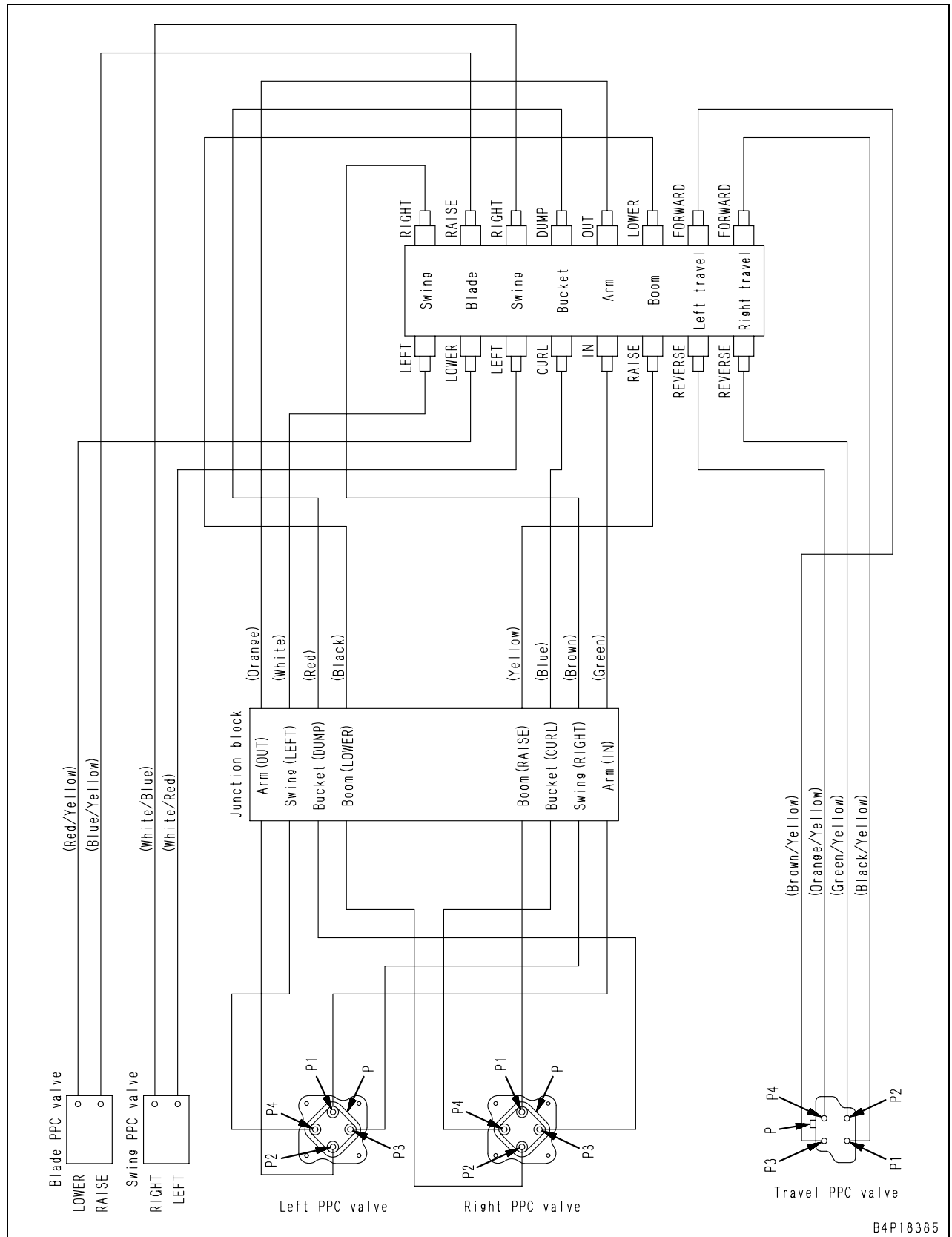
4. Tilt down the floor frame.
For details, see “How to open and close (tilt) floor”.
5. Run the engine at full throttle, operate the lever (pedal) of the circuit to be measured, and measure the PPC valve output pressure.

Connection diagram of PPC valve and control valve

- PC27MR-3



● PC35MR-3

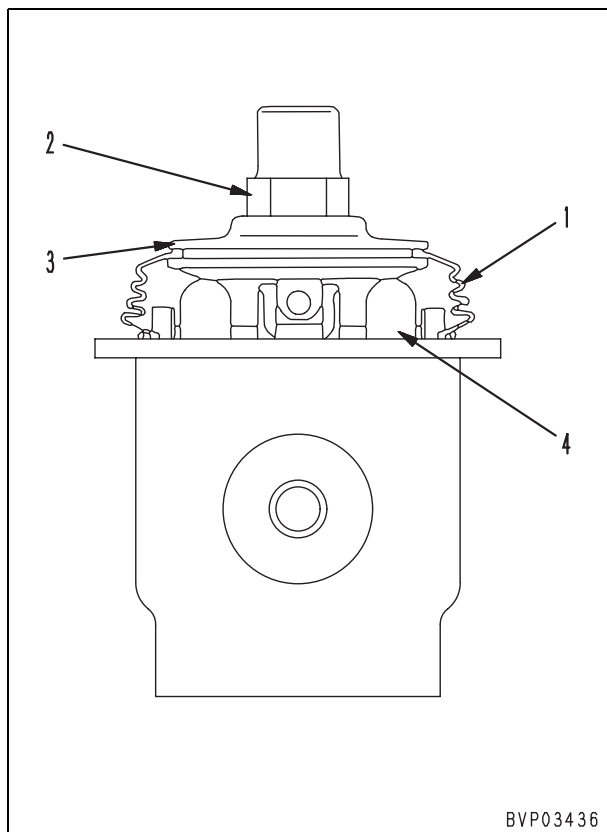


Adjusting PPC valve

- ★ If the work equipment/swing control lever has excessive play, adjust it according to the following procedure.

⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank and set the work equipment lock lever in the LOCK position.

1. Remove the PPC valve.
2. Remove boot (1).
3. Loosen locknut (2) and screw in disc (3) until it touches the heads of 4 pistons (4).
 - ★ At this time, do not move the pistons.
4. Fix disc (3) and tighten locknut (2) to the specified torque.
🔧 Locknut: **$107.9 \pm 9.8 \text{ Nm}$ { $11 \pm 1 \text{ kgm}$ }**
5. Install boot (1).
 - ★ After the above adjustment, clearance between disc (3) and piston (4) is eliminated.



Testing swing holding brake release pressure

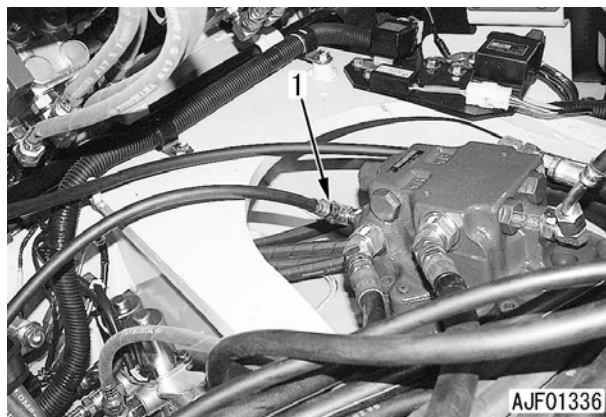
- ★ Measuring instruments for swing holding brake release pressure

Symbol	Part No.	Part Name
M	1	799-101-5002 Oil pressure gauge kit (Analog)
		790-261-1204 Oil pressure gauge kit (Digital)
	2	799-401-3100 Adapter
		02896-11008 O-ring

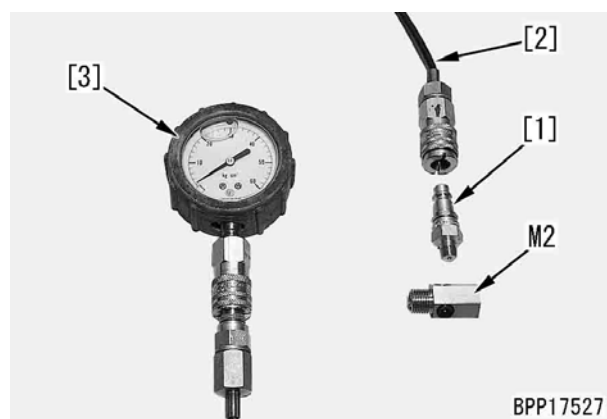
Measuring

- ★ Hydraulic oil temperature for measurement:
45 – 55°C

1. Tilt up the floor frame.
For details, see “How to open and close (tilt) floor”.
2. Disconnect swing motor inlet hose (1), install adapter **M2**, and install nipple [1] of oil pressure gauge kit **M1**.

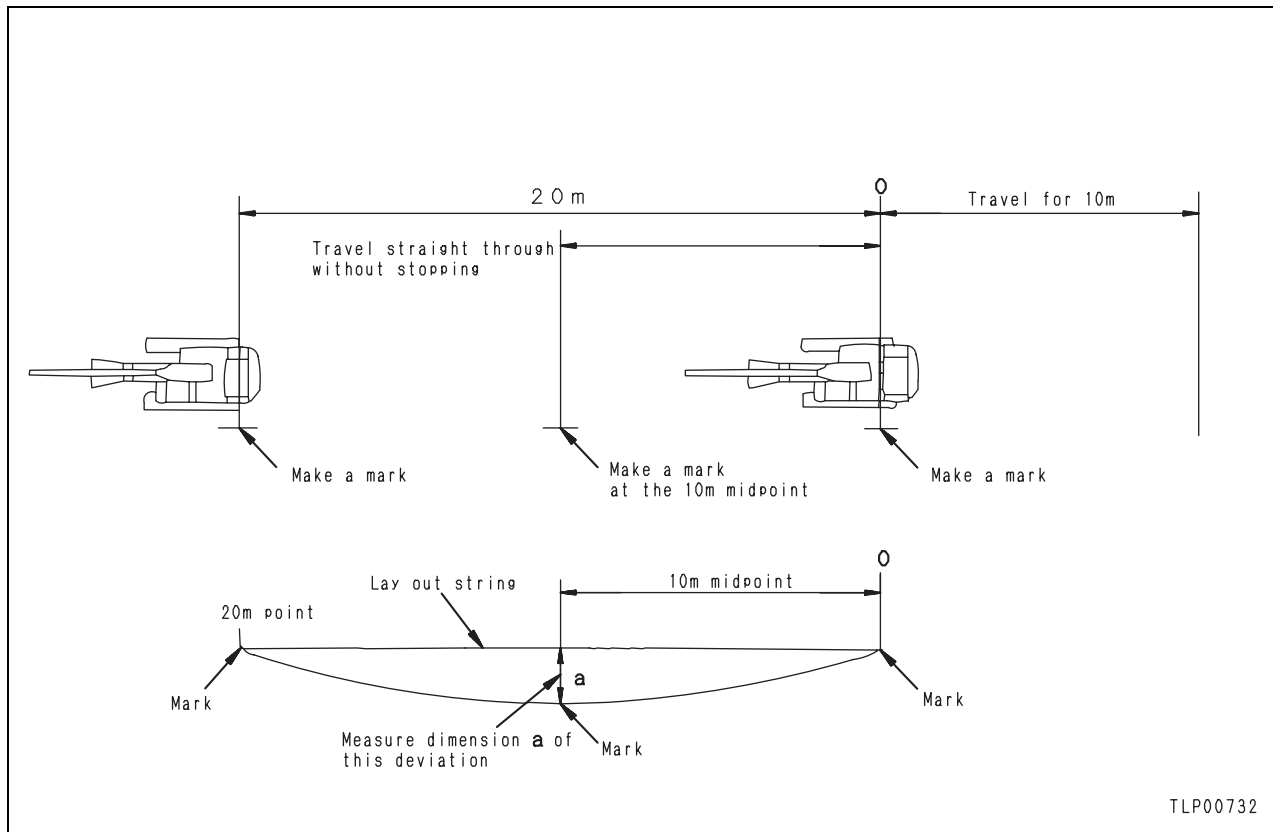


3. Connect oil pressure gauge [3] (6 MPa {60 kg/cm²}) by hydraulic hose [2].



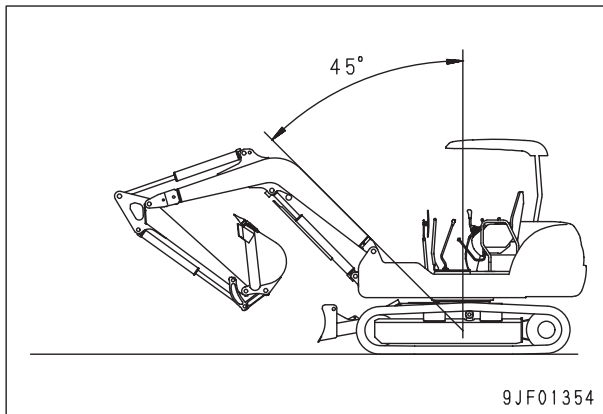
4. Tilt down the floor frame.
For details, see “How to open and close (tilt) floor”.
5. Run the engine at full throttle, swing to right or left or move the arm IN, and measure the swing holding brake release pressure.

Testing and adjusting travel deviation



Testing

- Set the machine to the travel posture.
 - ★ Extend the bucket cylinder and arm cylinder to the stroke end and set the boom angle to 45° .



- After approach run of 10 m, measure travel deviation (*a*) in the travel of 20 m after approach run.
 - ★ Keep running the engine at full throttle.
 - ★ Install an oil pressure gauge and measure the hydraulic pump discharge pressure, too.

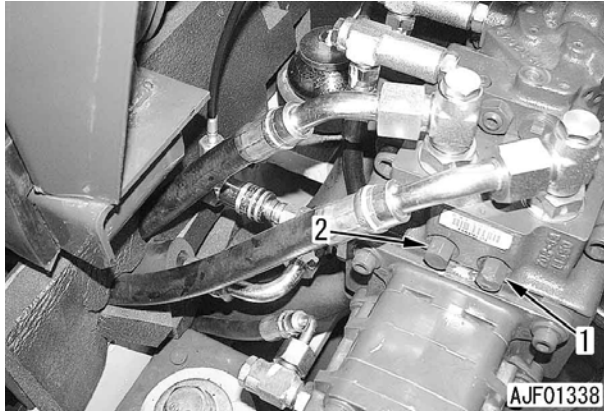
Adjusting

Note) Do not perform the following procedure for PC27MR-3 and PC30MR-3.

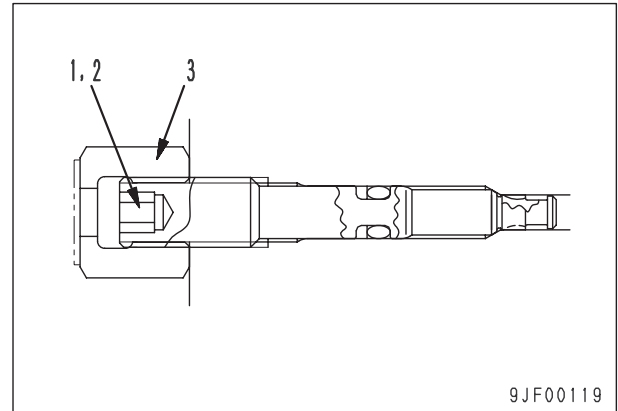
- ★ If the machine deviates, it can be corrected by partially draining the oil discharged more from the pump through the adjustment plug. (If the travel deviation is corrected by this method, however, the pump discharge is reduced. As a result, the travel speed, work equipment speed in compound operation, and relief pressure may lower.)
- ★ If the machine deviates in the same direction regardless of the travel direction, correct it according to the following procedure.
- ★ Only when the travel deviation is 200 mm or less, it can be corrected by the following method.
- ⚠ If the adjustment plug is loosened more than the adjustment limit, high-pressure oil will spout out. Take care extremely.
- ⚠ Lower the work equipment to the ground and stop the engine. Loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.

1. Remove the triangle cover from the left rear of the machine.
2. Check the locations of adjustment plugs (1) and (2) of the main pump.
 - (1): Right deviation adjustment plug
 - (2): Left deviation adjustment plug

PC35MR-3



7. Check the travel deviation again according to the above described testing procedure. If it is not corrected completely, adjust it again.
 - ★ Do not adjust more than the adjustment limit of the adjustment plug (2 turns/720°).



3. Insert hexagonal wrench (width across flats: 4 mm) in adjustment plug (1) or (2).
 - ★ Insert the hexagonal wrench securely.
4. Fix the hexagonal wrench and loosen locknut (3).
 - ★ Before loosening the locknut, make match marks on it and pump case to check its turning angle.
 - Loosening angle of locknut: 90 – 180°
5. Loosen adjustment plug (1) or (2) to adjust the travel deviation.
 - Amount of adjustment per turn of adjustment plug: 150 mm (Reference)
 - ★ The plug is fully tightened when shipped. Adjust the deviation by the loosening angle of the plug from the fully tightened position.
 - ★ When the locknut is loosened, if the adjustment plug is dragged, tighten the adjustment plug fully, and then adjust it again.
 - ☞ Adjustment plug:
2.94 – 4.9 Nm {0.3 – 0.5 kgm}
 - ★ The adjustment plug can be loosened by 2 turns (720°) from the fully tightened position.
6. Fix the adjustment plug with the hexagonal wrench and tighten locknut (3).
 - ☞ Locknut:
11.8 – 14.7 Nm {1.2 – 1.5 kgm}

Testing oil leakage from work equipment cylinder

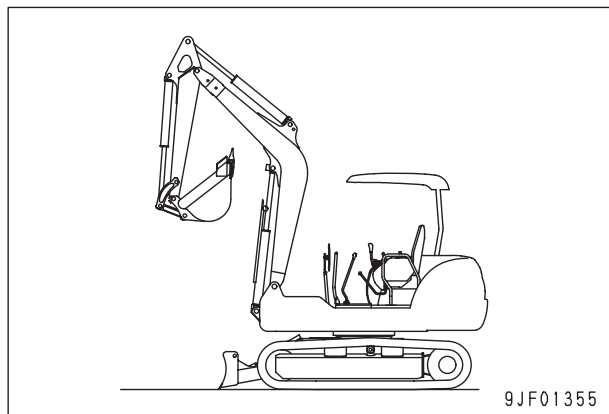
- ★ Measuring instruments for oil leakage from work equipment cylinder

Symbol	Part No.	Part Name
N	Commercially available	Measuring cylinder

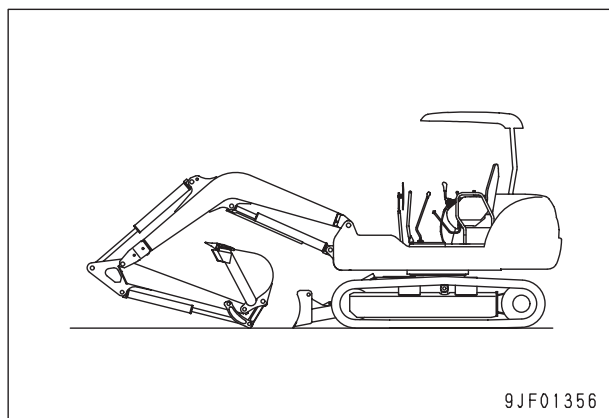
- ★ Hydraulic oil temperature for measurement:
45 – 55°C
- ★ If the hydraulic drift of the work equipment is out of the standard range, measure the leakage in the cylinder according to the following procedure to see if the cause of the hydraulic drift is on the control valve side.
- If the leakage is within the standard range, the cause is on the cylinder side.

1. Fully extend the rod of the cylinder to be measured and stop the engine.

- **Posture for measuring boom cylinder**



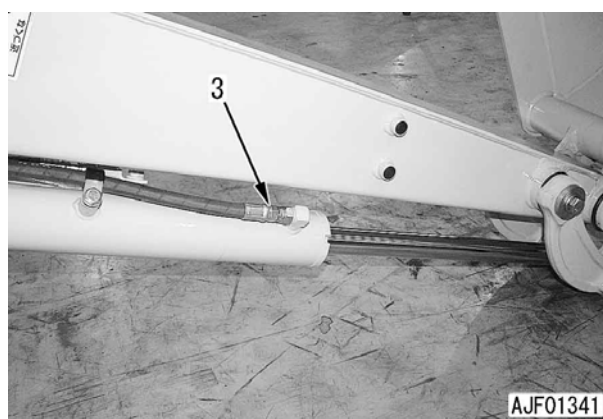
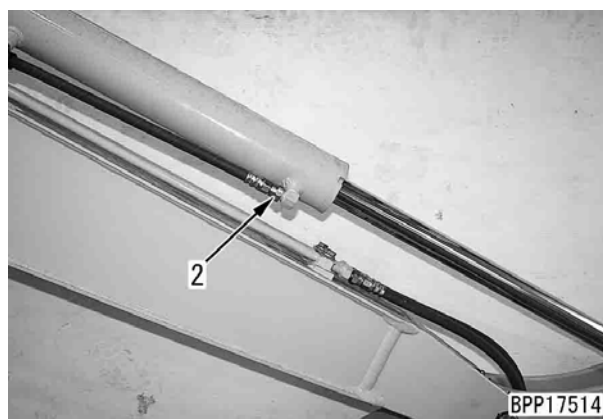
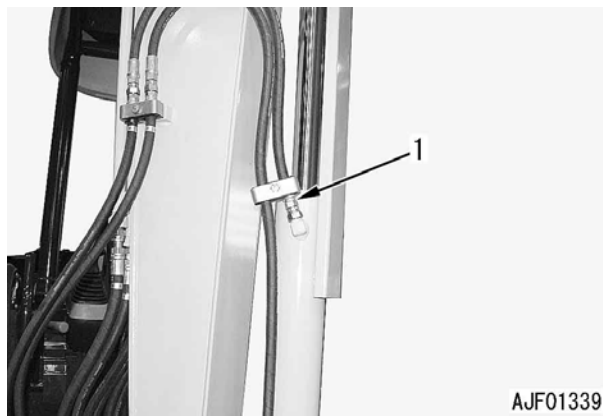
- **Posture for measuring arm cylinder and bucket cylinder**



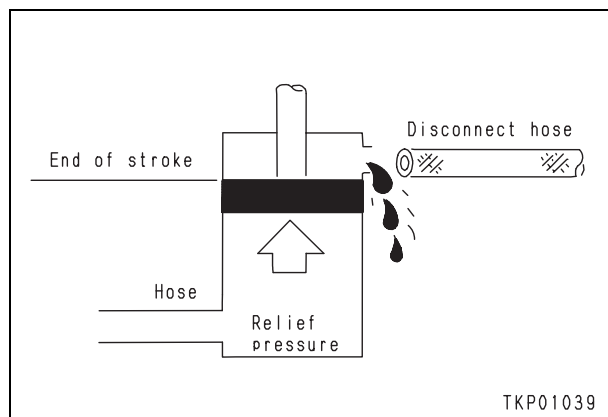
2. Disconnect the hose on the head side and plug the hose on the chassis side.

- Hose (1): Boom cylinder
- Hose (2): Arm cylinder
- Hose (3): Bucket cylinder

⚠ **Take care not to disconnect the hose on the cylinder bottom side.**



3. Run the engine at full throttle and apply the relief pressure to the bottom side of the cylinder.
 - ★ Boom cylinder: Operate to RAISE the boom.
 - Arm cylinder: Operate to move the arm IN.
 - Bucket cylinder:
Operate to CURL the bucket.
4. Relieve the oil for 30 seconds, and then measure the oil leakage for 1 minute.



Bleeding air from each part

Air bleeding item Contents of work	Air bleeding procedure						
	1	2	3	4	5	6	7
	Bleeding air from pump	Starting engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Pressurizing hydraulic tank	Starting operation
<ul style="list-style-type: none"> Replacement of hydraulic oil Cleaning strainer 	○	→○	→○	→○ (Note)	→○ (Note)	→○	→○
<ul style="list-style-type: none"> Replacement of return filter element 		○				→○	→○
<ul style="list-style-type: none"> Replacement or repair of pump Removal of suction piping 	○	→○	→○			→○	→○
<ul style="list-style-type: none"> Replacement or repair of control valve 		○	→○			→○	→○
<ul style="list-style-type: none"> Replacement or repair of cylinder Removal of cylinder piping 		○	→○			→○	→○
<ul style="list-style-type: none"> Replacement or repair of swing motor Removal of swing motor piping 		○		→○		→○	→○
<ul style="list-style-type: none"> Replacement or repair of travel motor and swivel Removal of travel motor and swivel piping 		○			→○	→○	→○

Note: Bleed air from the swing motor and travel motor only after the oil in the motor cases is drained.

1. Bleeding air from pump

- ★ Remove the triangular cover from the left rear of the machine.
 - ★ When masking cap is attached to bleeder, it detaches it.
 - 1) Loosen air bleeder (1) to bleed air.
 - ★ Bleed air until oil without air flows out.
 - 2) Tighten air bleeder (1).
 - ☞ Air bleeder:
- $8.8 \pm 1 \text{ Nm } \{0.9 \pm 0.1 \text{ kgm}\}$**
- ★ After the above work, run the engine at low idle for about 10 minutes.

PC27MR-3, PC30MR-3

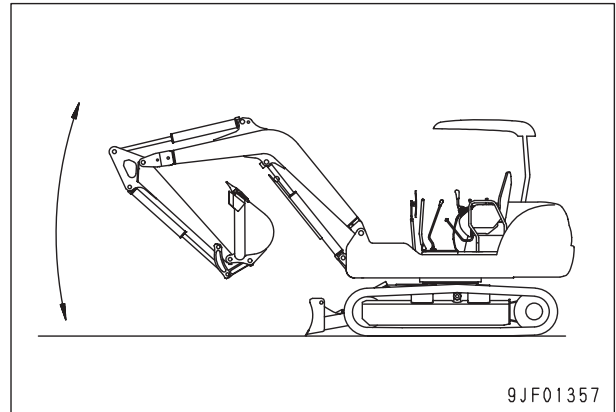


PC35MR-3



2. Bleeding air from cylinder

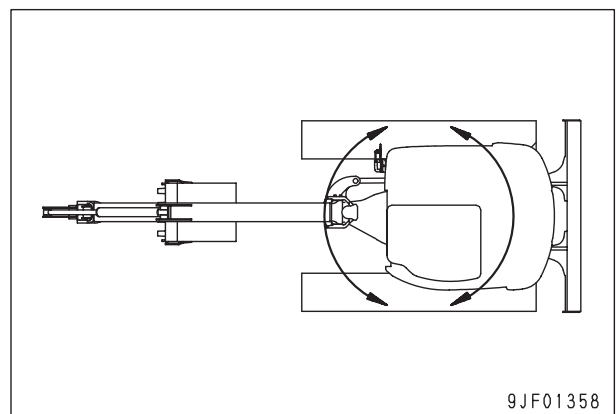
- 1) Run the engine at low idle for about 5 minutes.
- 2) Run the engine at slow speed and raise and lower the boom 4 – 5 times.
 - ★ Stop the piston rod about 100 mm before each stroke end. Never relieve the oil.



- 3) Run the engine at full throttle and perform step 2), then run the engine at low speed and move the piston rod to the stroke end and relieve the oil.
 - ★ Bleed air from the arm cylinder, bucket cylinder, boom swing cylinder, and blade cylinder according to steps 2) and 3).

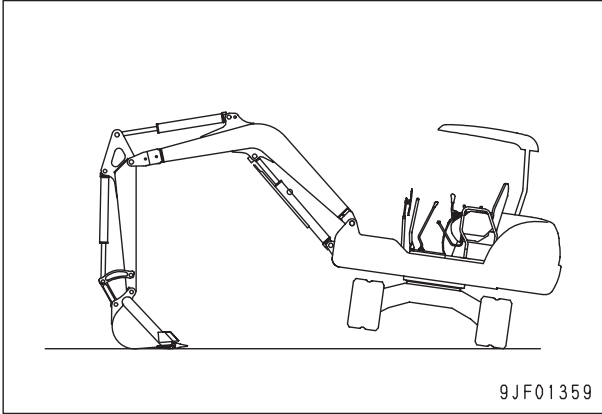
3. Bleeding air from swing motor

- 1) Run the engine at low idle and swing the upper structure to the left by 3 turns.
- 2) Swing the upper structure to the right by 3 turns.



4. Bleeding air from travel motor

- 1) Run the engine at low idle and float the left track shoe by using the work equipment.
- 2) Running the engine at low idle, rotate the left track shoe idle for about 30 seconds.
- 3) Performance procedures 1) and 2) for the right track shoe.

**5. Pressurizing hydraulic tank**

- 1) Before pressurizing the hydraulic tank, check the hydraulic oil level.
- 2) Referring to "Pressurizing hydraulic tank", pressurize the hydraulic tank.

Releasing residual pressure from hydraulic circuit

⚠ When disconnecting the piping between hydraulic cylinder, hydraulic motor and control valve, release the residual pressure in the circuit according to the following procedure.

- ★ There is not residual pressure in the swing motor circuit and travel motor circuit but the residual pressure in the hydraulic tank is applied to those circuits. Accordingly, perform the following procedure at least up to opening of the hydraulic tank cap.

1. Lower the work equipment to the ground and release the residual pressure in the hydraulic tank. For details, see "Releasing residual pressure in hydraulic tank".
2. Turn the starting switch ON and set the PPC lock lever in the reset position.
 - ★ If the power is not supplied to the PPC lock valve, the PPC lock valve does not operate. Accordingly, be sure to turn the starting switch ON.
3. Operate the lever to release the residual pressure in the piping.
 - ★ If the lever is operated 2 – 3 times, the pressure in the accumulator is lost.
4. Start the engine and run it for about 10 seconds at low idle to increase the pressure in the accumulator and then stop the engine.
5. Repeat steps 3 – 4 several times.
6. Loosen the sleeve nut of the piping gradually to release the residual pressure from the piping until oil does not come out any more, then remove the piping.

Releasing residual pressure from hydraulic tank

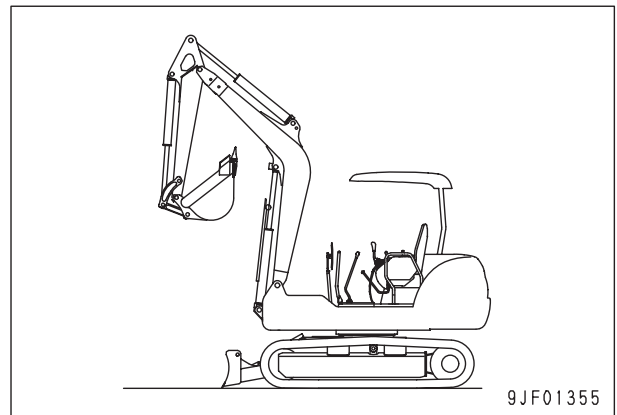
⚠ The hydraulic tank is enclosed and pressurized. When removing a hose or a plug connected to the hydraulic tank, release the residual pressure from the hydraulic tank according to the following procedure.

1. Lower the work equipment to the ground and stop the engine.
2. Loosen the oil filler cap of the hydraulic tank gradually to release the pressure from the tank.

Pressurizing hydraulic tank

★ If the oil filler cap is removed from the hydraulic tank, pressurize the hydraulic tank according to the following procedure.

1. Run the engine at low idle and set the work equipment in the position for pressurizing the hydraulic tank (Extend the rods of the boom, arm, and bucket cylinders to the respective stroke ends).
2. Stop the engine and open the oil filler cap of the hydraulic tank and tighten it again.
3. Start the engine and lower the work equipment to the ground.
★ The hydraulic tank is pressurized by the above operation.

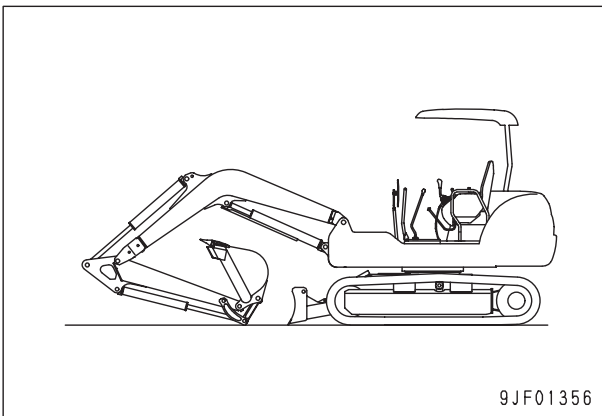


How to open and close (tilt) floor

- ★ When testing or servicing the underside of the floor or inside of the revolving frame, open and close (tilt) the floor according to the following procedure.

Opening (Tilting open)

1. Move the arm in and lower the boom until the work equipment and blade touch the ground.
 - ★ If the machine is not set in this state, the cab (canopy) tilted up will interfere with the work equipment etc. and will be damaged. Accordingly, perform this work securely.



2. Stop the engine and set the work equipment lock lever in the lock position.
3. Put blocks to the front and rear of the track shoes to secure the machine.
4. Remove triangular cover (1).



5. Remove cover (2).
 - ★ Cab specification



6. Open cover (3).
 - ★ Cab specification only

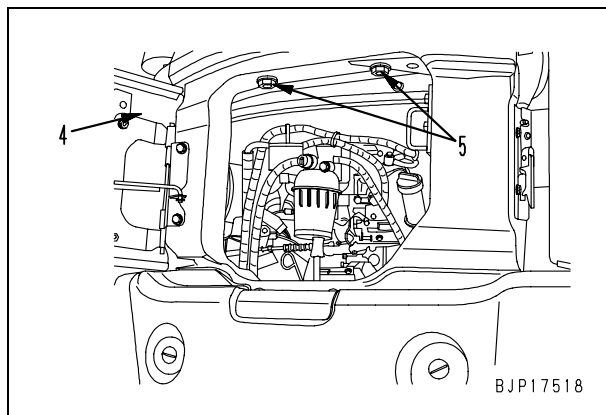


7. Open engine rear cover (4) and lock it.

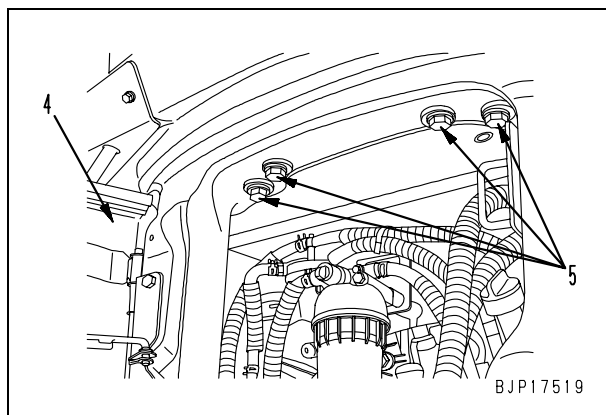
8. Loosen floor tilt lock bolts (5).

- ★ The bolts are designed so that they will not be removed completely when they are simply loosened to prevent them from falling.

★ Canopy specification



★ Cab specification



9. Close the engine rear cover.

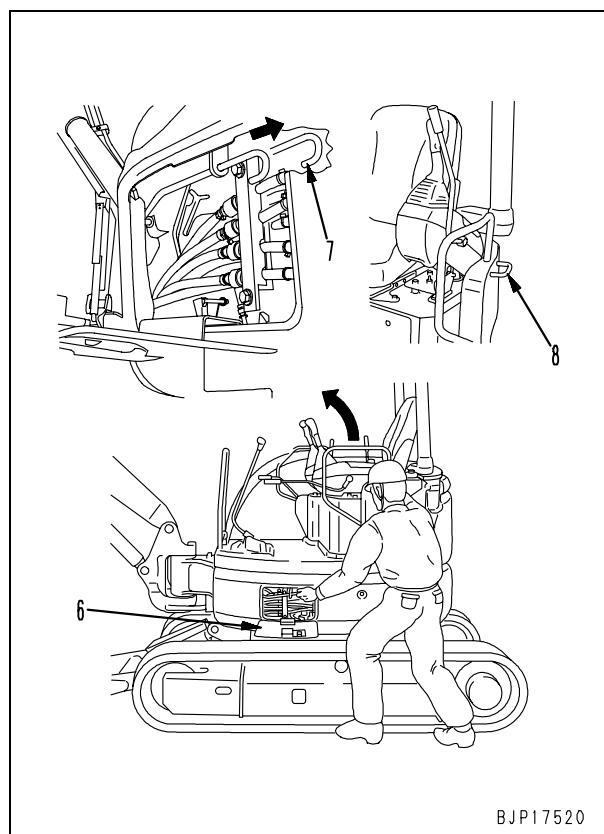
10. Open inspection window (6). While pulling floor lock release lever (7) in the direction of the arrow with the left hand, push up handle (8) with the right hand in the direction of the arrow (about 45°).

- Machine with canopy: The floor and canopy rise together.
- Machine with cab: The floor and cab rise together.

★ If the floor does not rise, release lever (7) is not in the release position. In this case, pull back handle (8) with the right hand and perform the above procedure again.

⚠ Do not put any part of your body under the floor while opening or closing the floor.

★ Since the gas cylinder assists you in opening the floor, the operating effort is increased when the ambient temperature is low. Take care.



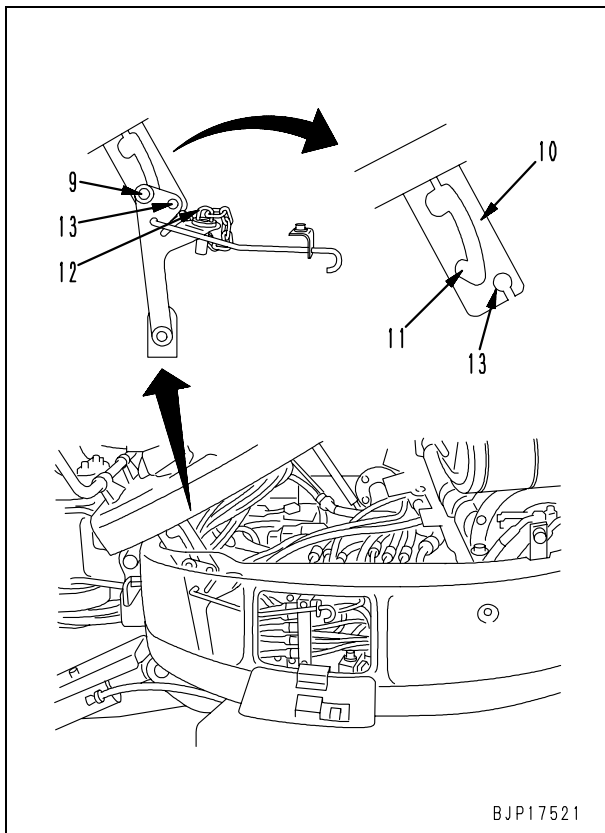
11. After the floor rises, push up handle (8) until lock pin (9) is fitted to lock groove (11) of lock plate (10).

- ★ When lock pin (9) moves to lock groove (11), the 1st locking is completed.

12. Insert 2nd lock pin (12) in lock hole (13) securely.

13. Ensure that the lock hook at the top of lock pin (12) is hitched on pin (14) at the insertion section and does not come off.

- ★ Check that lock pin (12) is hitched on pin (14) and does not come off.



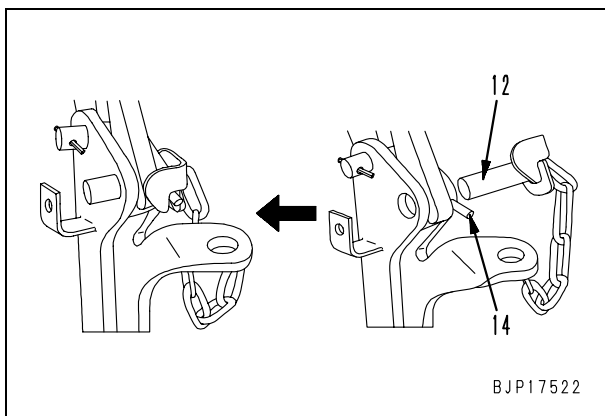
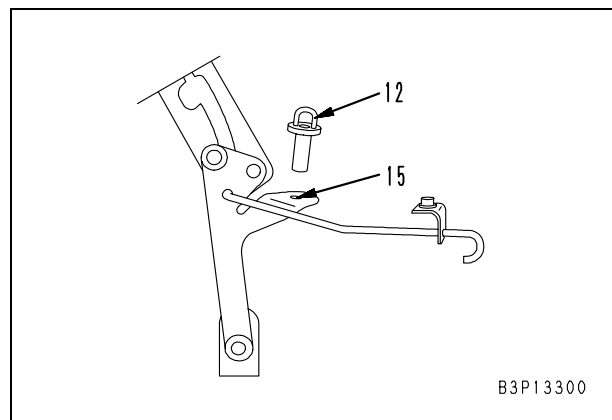
Closing (Tilting close)

- ★ Before closing the floor, check that the wiring, piping, and seats on the underside of the floor and inside of the revolving frame are free from damage and abnormality.

1. Remove lock pin (12) and insert it in storage hole (15).

- ★ If you cannot remove the lock pin, perform the following work.

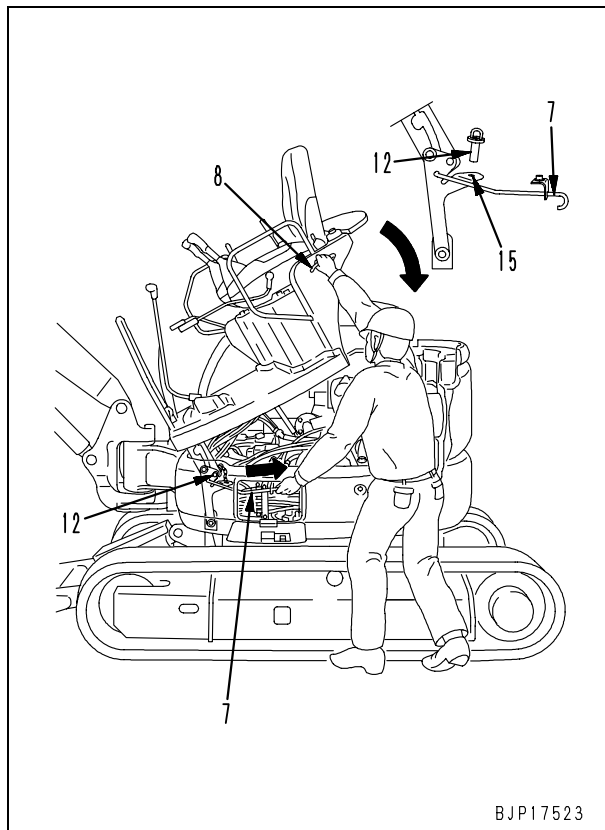
- Canopy specification: While holding the handle and pushing up the floor, pull out the lock pin.
- Cab specification: While holding the handle and pushing down the floor, pull out the lock pin.



2. While pulling floor lock release lever (7) in the direction of the arrow (backward) with the left hand, pull down handle (8) slowly with the right hand in the direction of the arrow (about 45°).

★ While checking that the wiring and piping are not caught or damaged, pull down the floor slowly.

⚠ **Do not put any part of your body under the floor while opening or closing the floor.**

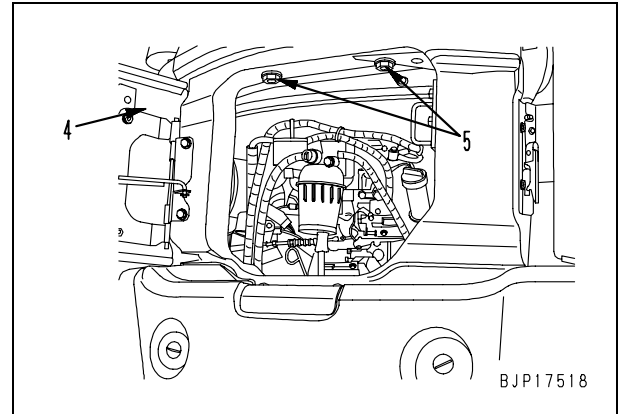


3. Open and lock engine rear cover (4).

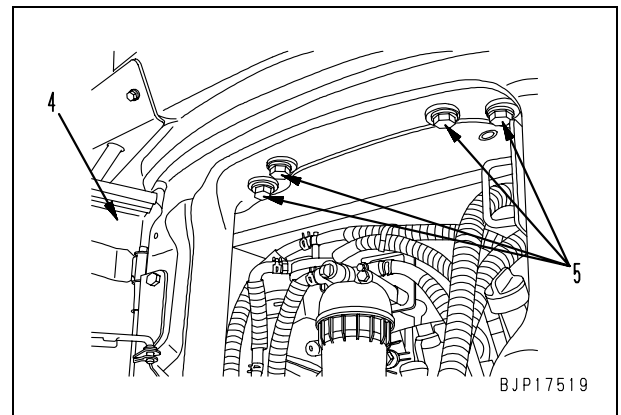
4. Tighten floor tilt lock bolts (5).

⚙ Lock bolt: **156 – 196 Nm {16 – 20 kgm}**

★ Canopy specification



★ Cab specification



5. Close the engine rear cover.

6. Close cover (3).



7. Install cover (2).
★ Cab specification



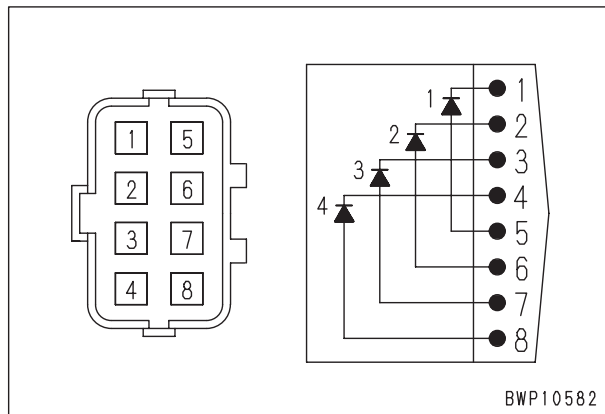
8. Install rectangular cover (1).



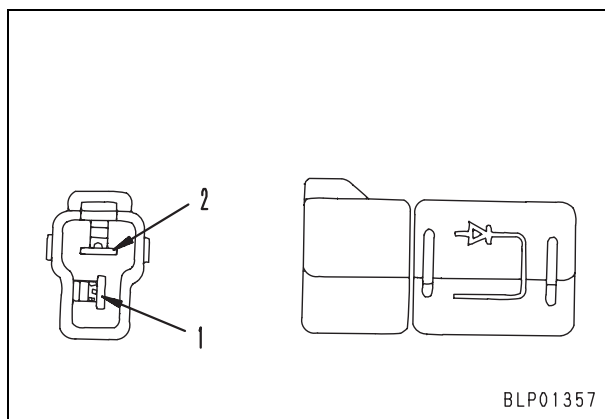
- ★ The floor closing (tilting close) work is finished.

Inspection procedures for diode

- ★ Check an assembled-type diode (8 pins) and single diode (2 pins) in the following manner.

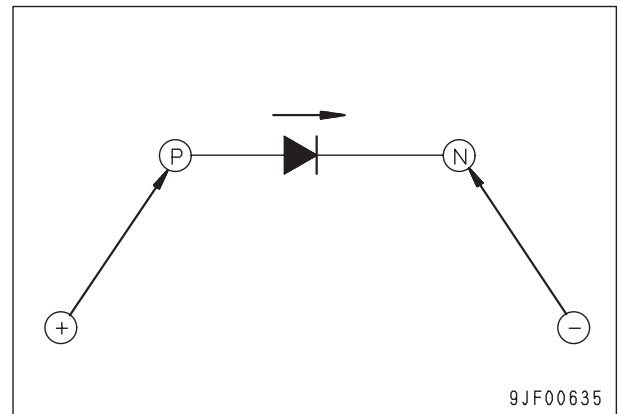


- ★ The conductive direction of each diode is marked on its surface as shown below.



1. When using digital type circuit tester

- 1) Switch the testing mode to diode range and confirm the indicated value.
 - ★ Voltage of the battery inside is displayed with conventional circuit testers.
 - 2) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode, and confirm the displayed value.
 - 3) Determine if a specific diode is good or no good with the indicated value.
 - No change in the indicated value: No continuity (defective).
 - Change in the indicated value: Continuity established (normal) (Note)
- Note: A silicon diode shows a value between 460 and 600.



2. When using analog type circuit tester

- 1) Switch the testing mode to resistance range.
- 2) Check the needle swing in case of the following connections.
 - i) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode.
 - ii) Put the red probe (+) of the test lead to the cathode (N) and the black probe (–) to the anode (P) of diode.
- 3) Determine if a specific diode is good or no good by the way the needle swings.
 - If the needle does not swing in Case i), but swings in Case ii): Normal (but the breadth of swing (i.e. resistance value) will differ depending on a circuit tester type or a selected measurement range)
 - If the needle swings in either case of i) and ii): Defective (short-circuited internally)
 - If the needle does not swing in any case of i) and ii): Defective (short-circuited internally)

How to start operation of KOMTRAX terminal

In the case where the KOMTRAX terminal has already been installed at the plant before shipment:

- ★ Implement the following procedure in the case where the KOMTRAX terminal has already been installed at the plant before shipment (as standard equipment).

1. Notification of model, model number and serial number

Notify the model, model number and serial number of the machine to the KOMTRAX operations administrator.

2. Registration of machine

The KOMTRAX operations administrator registers the machine using a KOMTRAX client personal computer.

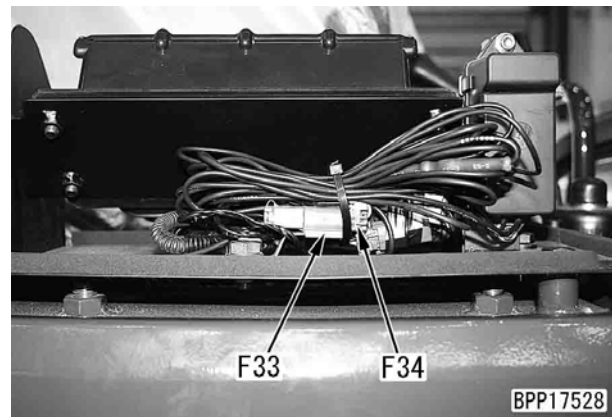
- ★ For the procedure, see "Manual for KOMTRAX operations administrator".
- ★ Now the terminal is ready for use.

In the case where the KOMTRAX terminal is retrofitted on the machine after shipment:

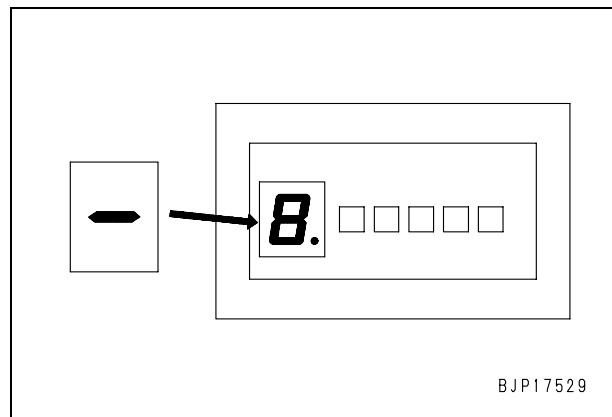
- ★ Implement the following procedure in the case where the KOMTRAX terminal is retrofitted after shipment of the machine (retrofitted machine).

1. Sign-up test on machine side

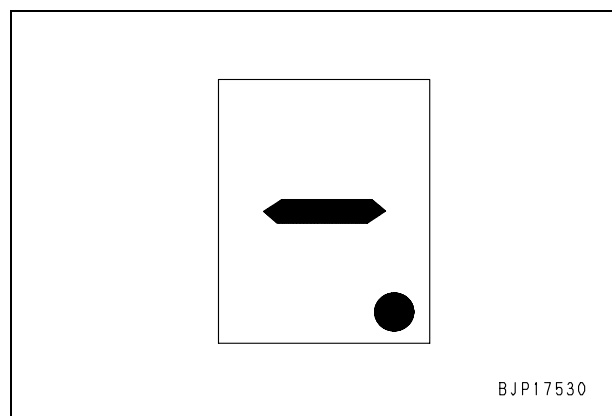
- ★ Complete procedures 4) – 6) in 60 seconds.
- 1) Park the machine in a place sufficiently apart from buildings etc. where its top is seen from every direction so that it can receive the radio waves from the satellite.
 - ★ The inspection cannot be completed normally indoors. Be sure to perform the inspection outdoors.
- 2) Turn the starting switch OFF and wait for at least 5 seconds and then go to the next step.
- 3) Check visually that the test connectors under KOMTRAX terminal (1) are connected.
 - ★ Test connectors: F33, F34 (male, female)



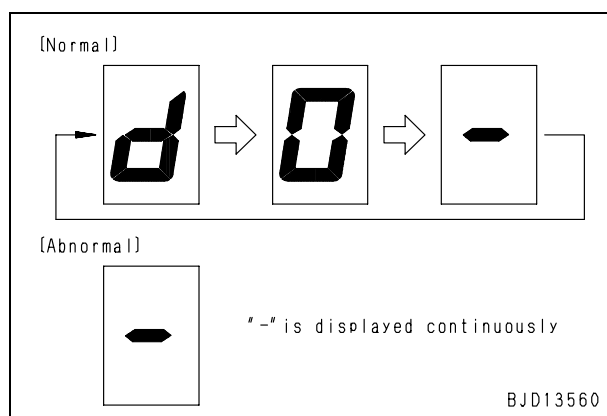
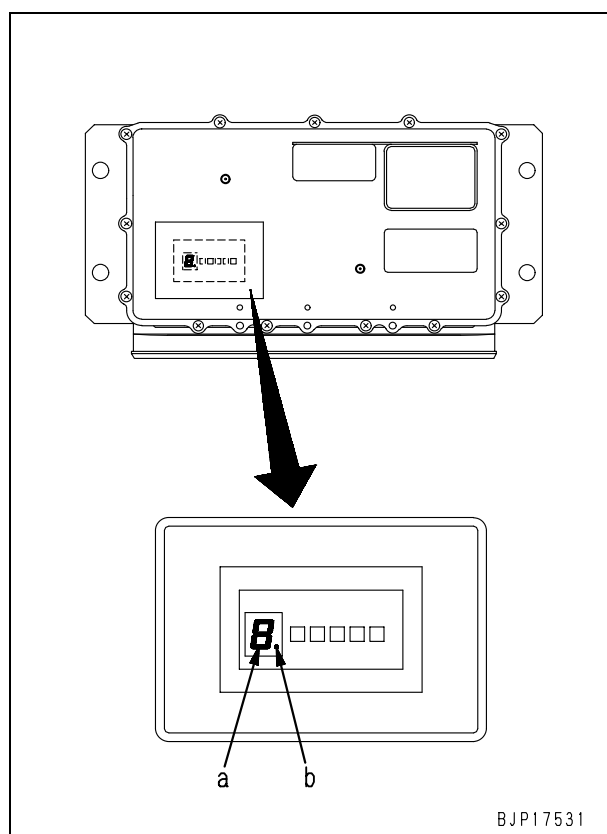
- 4) Turn the starting switch ON and keep that condition for 5 seconds.
 - Check that the 7-segment indicator lamp indicates a bar.



- 5) Disconnect test connectors F33 and F34 and keep that condition for 5 seconds.
- 6) Reconnect test connectors F33 and F34 and keep that condition for 5 seconds.
 - ★ If the KOMTRAX terminal detects disconnection or reconnection of the connectors, the dot of the 7-segment indicator lamp blinks 2 – 3 times.
 - ★ If procedures 4) – 6) are not completed in 60 seconds, repeat from 2).



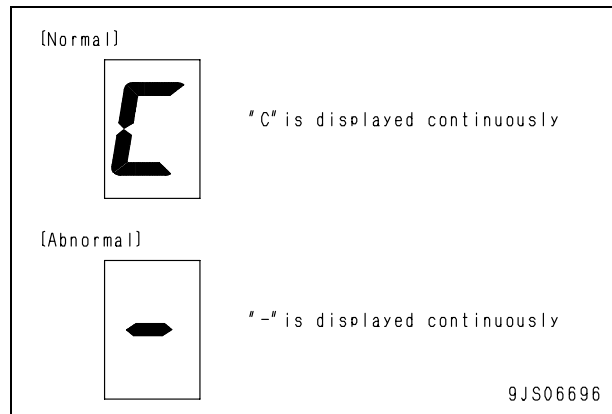
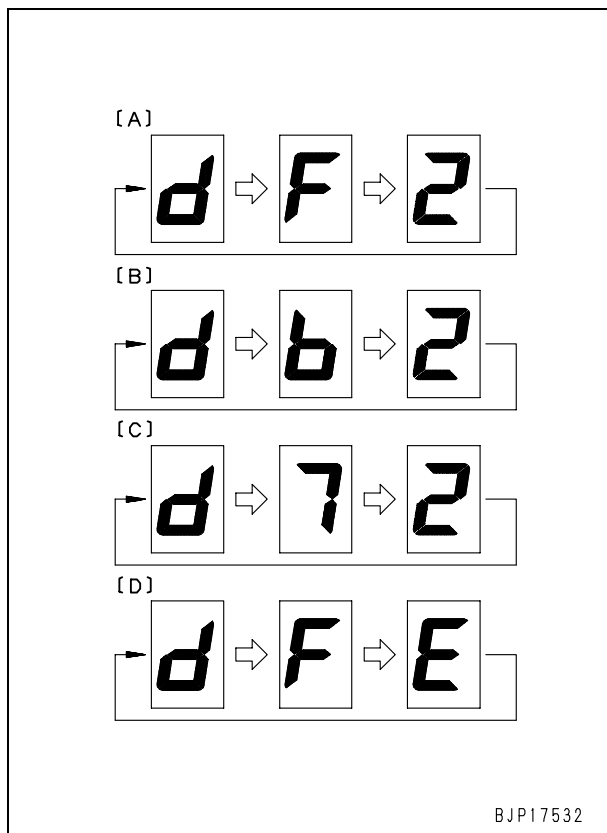
- 7) Check that the 7-segment indicator lamp of the KOMTRAX terminal is displaying normally.
 - ★ If the indication is normal, the 7-segment indicator lamp (a) is displayed for 30 seconds after 6) is completed. ("d", "0" and "-" are displayed repeatedly.)
 - Display of the 2nd letter "0" may be different from the first.
 - Display of the 3rd letter "-" changes 30 seconds after the operation of 6).



- ★ Go to the next step if you can check that the display is "normal".
 - ★ If the display is "abnormal", repeat from procedure 2) again. ("—" is displayed continuously.)
- 8) Turn the starting switch to the START position, keep it more than 5 seconds, and check that the engine does not start.
 - ★ If the engine starts, repeat from procedure 2).
 - ★ If the engine starts again, the engine start lock function does not work normally. Stop the inspection and check of the relays and wiring harnesses for trouble.
- 9) Return the starting switch to the ON position and keep it there for 5 seconds.
 - ★ Do not return the starting switch to the OFF position.
- 10) Turn the starting switch to the START position again and ensure that the engine starts.
- 11) Check that the 7-segment indicator lamp of the KOMTRAX terminal is indicating normally without stopping the engine.
 - ★ Go to the next step if you ensured that the display is [normal]. (It takes from 90 seconds to 15 minutes before the display turns normal.)
 - ★ If [GPS position data detection trouble] is indicated, check if there is any external abnormality on the GPS antenna or cable. If there is any abnormality, repair it and repeat from procedure 1) again.
 - ★ If [Reception trouble] is indicated, check if there is any external abnormality on the appearance of the communication antenna or cable. If there is any abnormality, repair it then repeat from procedure 1) again.
 - ★ If [GPS position data detection trouble and reception trouble] is indicated, check if there is any external abnormality on the GPS antenna or cable and communication antenna or cable. If there is any abnormality, repair it and repeat from procedure 1) again.
 - ★ If [Network trouble] is indicated, check the display of [LED-4] referring to "Lamp display of KOMTRAX terminal". (If CAN is not recognized, check the CAN harness of the KOMTRAX terminal, and then if there is any abnormality, repair it and repeat from procedure 1) again.)

- [A]: Normal finish (It takes at least 90 seconds for the system to display this)
- [B]: GPS position data detection trouble
"Check the GPS antenna and cable for external abnormality."
(It takes 90 seconds – 5 minutes)
- [C]: Incomplete receiving
"Check the communication antenna and cable for external abnormality."
(It takes 30 seconds – 1 minute)
- [D]: Network trouble or wiring harness trouble
"The network type selection input does not agree with the obtained network data."
"Check the machine wiring for an error."

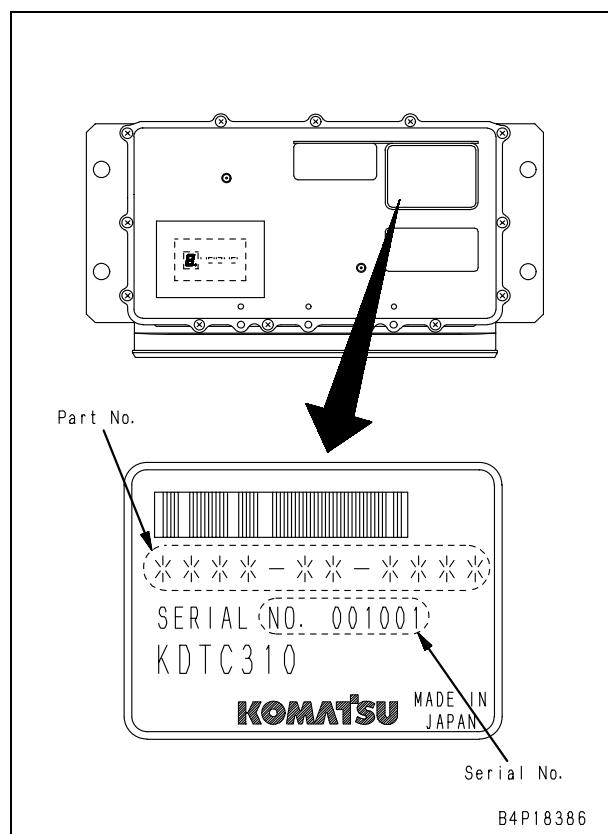
- 12) Turn the starting switch OFF.
- 13) Check that the 7-segment indicator lamp is indicating normally in 10 seconds.
- ★ If you checked that the display is [Normal], that is the end of the sign-up test.
 - ★ If the display shows [Abnormal], repeat from procedure 1) again because the sign-up test has not been completed successfully.



- ★ If the display is not any of the above, call Customer Support Division.
- ★ It takes 90 seconds – 5 minutes for the system to display "Normal finish" after the operation of 6).

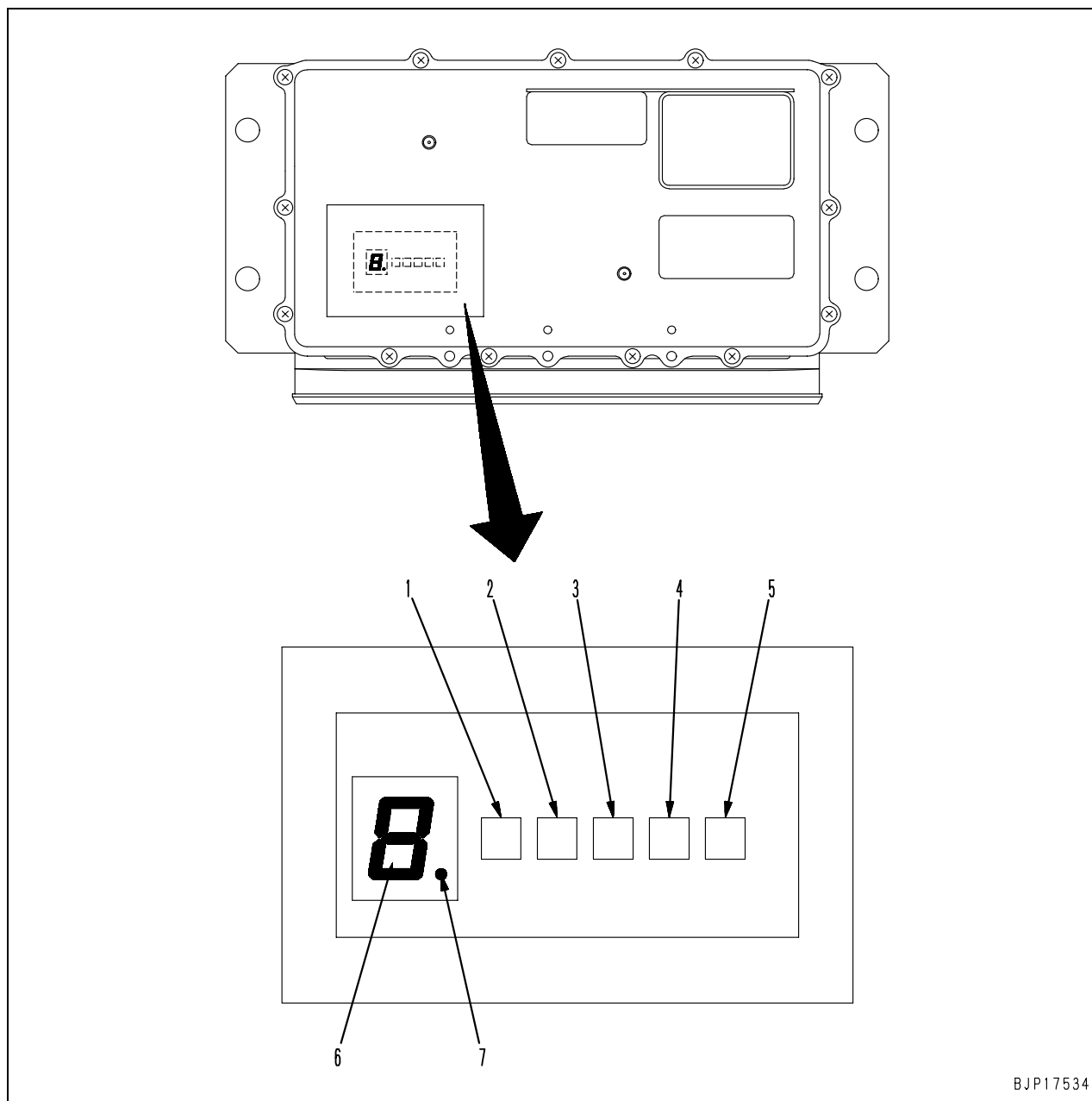
2. Application for the start of use

- ★ Application for the start of use must be made only after the sign-up test is finished.
- 1) Notify to the KOMTRAX operations administrator of the following information concerning the machine whose sign-up test on the machine side is completed.
 - 1] Information on the machine whose sign-up test on the machine side is completed (Model, model number and serial number)
 - 2] Part number and serial number of the KOMTRAX terminal
 - 3] Reading of the service meter when the KOMTRAX terminal was installed (0.1h unit)



- 2) The KOMTRAX operations administrator registers the machine using KOMTRAX client personal computer.
 - ★ For the procedure, see "Manual for KOMTRAX operations administrator".
 - ★ Now the terminal is ready for use.

Lamp display of KOMTRAX terminal



BJP17534

CPU LED

1. LED-1 (R signal and ACC signal)
2. LED-2 (Starting output status)
3. LED-3 (S-NET status and C signal status)
4. LED-4 (Fuel sensor and CAN connection status)
5. LED-5 (Downloading and writing status)

7-segment and dot for CPU

6. 7-segment (Sign-up test status and operation status)
7. Dot (GPS positioning status and test connector disconnection/connection status)

In the KOMTRAX system, various information and processing details are displayed on the LED of the upper surface of the KOMTRAX terminal. Therefore, if a defect is suspected in the system, perform the following checks.

- Check of antennas
- Check of terminal LED displays

Application for the start of use and sign-up test on the machine side must be completed in advance in order to use KOMTRAX system.

Check of antennas

- ★ Before checking the LED displays, check that there is no abnormality around the communication antenna and GPS antenna.
- The communication antenna must not be off or damaged.
- The communication antenna cable must not be broken and must be connected to the KOMTRAX terminal normally.
- The GPS antenna must not be off or damaged.
- The GPS antenna cable must not be broken and must be connected to the KOMTRAX terminal normally.

1. Contents of CPU LED, 7-segment and dot displays

- ★ The LED displays must be checked with the starting switch in the ON or START position or with the engine started.

No.	LED (Color)	Name/Function	Display (*1)	Contents of display
1	LED-1 (Green)	Starting switch ACC signal and alternator R signal	ON	Starting switch ACC signal: ON, alternator R signal: ON
			Fast blinking	Starting switch ACC signal: OFF, alternator R signal: ON
			Slow blinking	Starting switch ACC signal: ON, alternator R signal: OFF
			OFF	Starting switch ACC signal: OFF, alternator R signal: OFF
2	LED-2 (Red)	Starting output status	ON	Engine control signal: ON
			OFF	Engine control signal: OFF
3	LED-3 (Yellow)	S-NET connection status and starting switch C signal status	Fast blinking	Starting switch C signal: ON
			ON	Starting switch C signal: OFF, S-NET connection: Made
			OFF	Starting switch C signal: OFF, S-NET connection: Not made
4	LED-4 (Green)	Fuel sensor and CAN connection status	ON	CAN: Connected, (Fuel sensor: Disconnected)
			Fast blinking	CAN: Connected, (Fuel sensor: Connected)
			Slow blinking	CAN: Disconnected, (Fuel sensor: Connected)
			OFF	CAN: Disconnected, (Fuel sensor: Disconnected)
5	LED-5	Downloading and writing status	ON	Downloading and writing mode: ON
			OFF	Downloading and writing mode: OFF (Normal mode)
6	7-segment	Before execution of sign-up test		
		Sign-up status	[—]	When sign-up test is not completed, “—” (bar) is always displayed.
		During sign-up test		
		Sign-up progress status	*	* For display during sign-up test, see “How to start operation of KOMTRAX terminal”.
		After completion of sign-up test		
		Initialization communication incompleteness status	[C] ON Fast blinking	If server initialization communication is not completed, [C] is displayed. “ON” indicates that machine is within communication range. “Fast blinking” indicates that machine is out of communication range.
		Operation status		
		Number of unsent mails or within/out of communication range status	[0 – 9] ON	Figure indicates number of mails waiting for to be sent (9 is displayed when number is 9 or larger). “ON” indicates that terminal is capturing satellite.
			[0 – 9] Fast blinking	Figure indicates number of mails waiting for to be sent (9 is displayed when number is 9 or larger). Fast blinking indicates that terminal has not captured satellite.
7	Dot (Red)	GPS connector positioning/ Test connector disconnection and connection status	ON	GPS positioning has been executed. See *2.
			OFF	GPS positioning has not been executed. See *2.
			Fast blinking	If sign-up test connector is disconnected or connected, dot blinks 2 – 3 times.

***1 Types and periods of blinking**

Fast blinking: Blinking at cycles of about 1 second (ON for 0.5 seconds → OFF for 0.5 seconds)

Slow blinking: Blinking at cycles of about 4 seconds (ON for 2 seconds → OFF for 2 seconds)

***2 It may take more than 1 minute from turning on the starting switch to the completion of positioning even in an outdoor place where radio wave can reach.**

Positioning is impossible in areas with extremely weak radio waves or areas beyond the reach of radio waves.

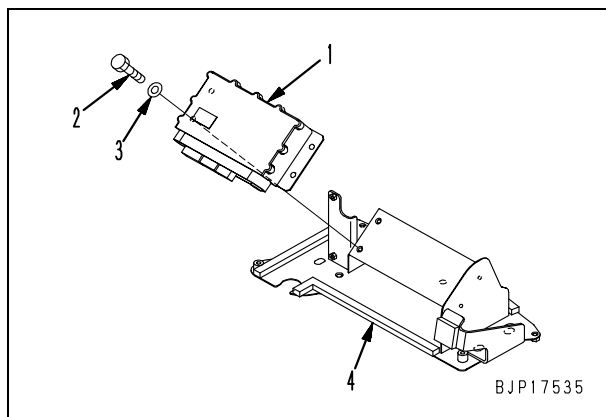
Removal and installation of KOMTRAX terminal

Removal

1. Turn the starting switch to the OFF position.
2. Remove the cover, garnish, etc. to expose KOMTRAX terminal (1).
3. Remove the cab wiring harness from KOMTRAX terminal (1).
 - ★ Be sure to remove the cab wiring harness before the antenna cable (described in step 4).
4. Remove the communication antenna cable and GPS antenna cable from KOMTRAX terminal (1).
5. Remove all mounting bolts (2) and washers (3) of the KOMTRAX terminal.
Reference: The mounting bolt size is M8.
6. Remove KOMTRAX terminal (1) from bracket (4).
 - ★ When handling the KOMTRAX terminal, take care not to give an impact on it.
(Never hit it against another part or drop it.)

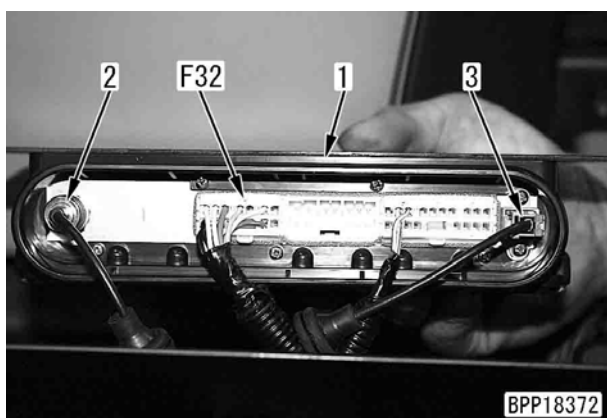
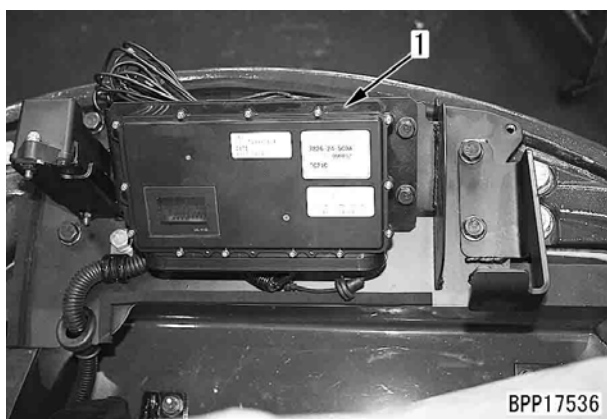
Installation

- Carry out installation in the reverse order to removal.



Preparation work for troubleshooting of electrical system

- ★ When carrying out troubleshooting of an electric circuit related to the KOMTRAX terminal, expose the related connectors according to the following procedure.
 - ★ The KOMTRAX terminal is installed at the rear of the operator seat.
1. Remove the top cover of the KOMTRAX terminal.
 2. Remove KOMTRAX terminal (1).
 3. Insert or connect a troubleshooting T-adapter to connector F32 of KOMTRAX terminal (1).
 - ★ Cable (2) is for the communication antenna (system 1).
 - ★ Cable (3) is for the GPS antenna.



PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04381-01

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

40 Troubleshooting

100 General information on troubleshooting

Points to remember when troubleshooting	2
Sequence of events in troubleshooting.....	3
Checks before troubleshooting	4
Classification and procedures of troubleshooting	5
Information contained in troubleshooting table	6
Connection table for connector pin numbers	10
T- branch box and T- branch adapter table	46

Points to remember when troubleshooting

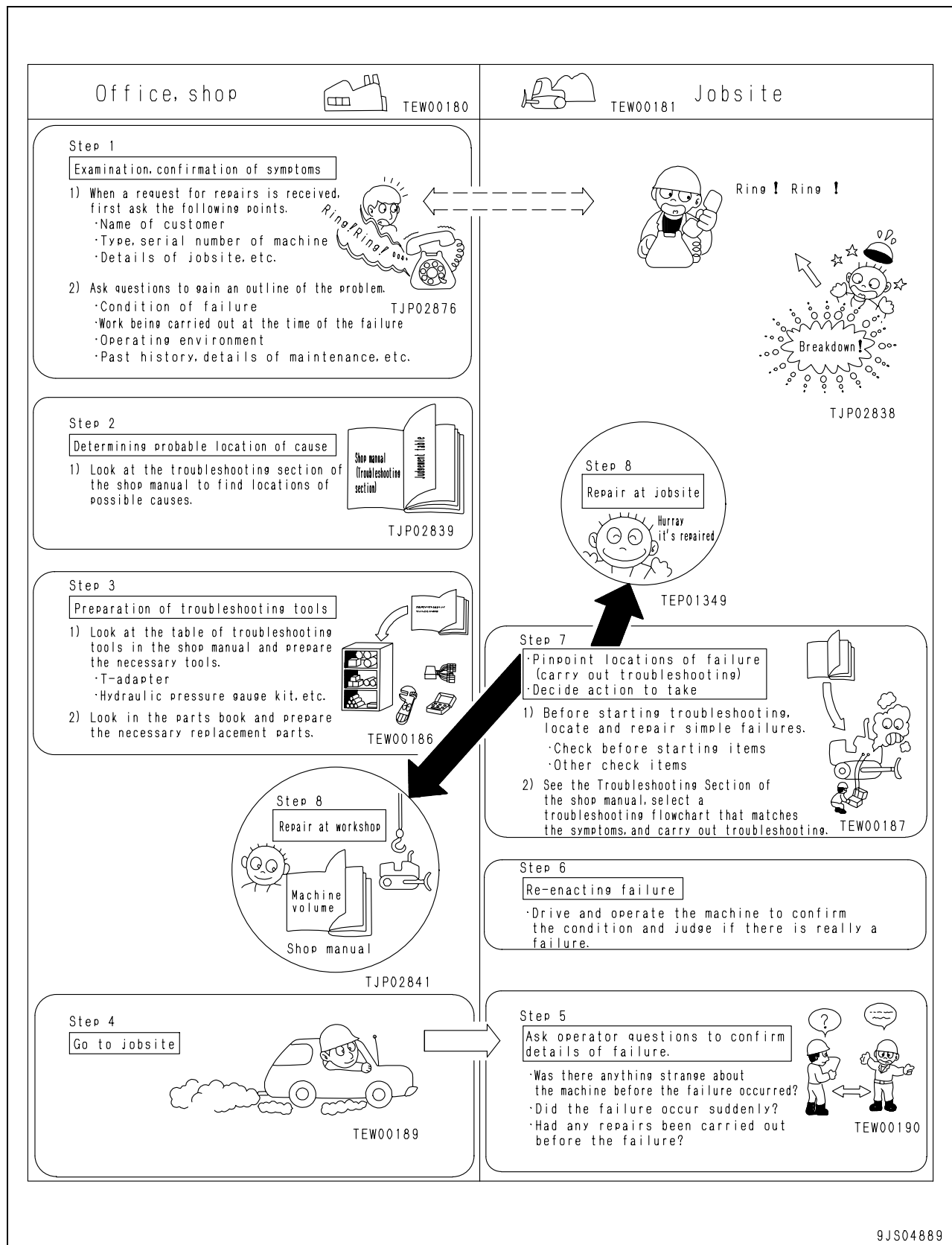
- ⚠ Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.
- ⚠ When carrying out the operation with 2 or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.
- ⚠ If the radiator cap is removed when the engine is hot, hot coolant may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.
- ⚠ Be extremely careful not to touch any hot parts or to get caught in any rotating parts.
- ⚠ When disconnecting wiring, always disconnect the negative (–) terminal of the battery first.
- ⚠ When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure. When carrying out troubleshooting, an important point is of course to understand the structure and function. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
If components are disassembled immediately after any failure occurs:
 - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
 - It will become impossible to find the cause of the failure.

It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask user or operator
 - 1) Have any other problems occurred apart from the problem that has been reported?
 - 2) Was there anything strange about the machine before the failure occurred?
 - 3) Did the failure occur suddenly, or were there problems with the machine condition before this?
 - 4) Under what conditions did the failure occur?
 - 5) Had any repairs been carried out before the failure? When were these repairs carried out?
 - 6) Has the same kind of failure occurred before?
3. Check before troubleshooting
 - 1) Are abnormal symptoms detected in the machine?
 - 2) Make checks before starting day's work.
 - 3) Make checks of other items.
 - 4) Check other maintenance items which can be visually checked and are considered necessary.
4. Confirming failure
Confirm the extent of the failure by yourself, and judge whether to treat it as a real failure or as a problem of handling, operation, etc.
 - ★ When operating the machine to reenact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting
Use the results of the investigation and inspection in items 2 – 4 to narrow down the causes of failure, then use the troubleshooting table or flowchart (matrix) to find out the failure part exactly.
 - ★ The basic procedure for troubleshooting is as follows.
 - 1] Start from the simple points.
 - 2] Start from the most likely points.
 - 3] Investigate other related parts or information.
6. Measures to remove root cause of failure
Even if the immediate failure is repaired, the same failure may occur again, unless the root cause of the failure is repaired. To prevent this, always investigate why the cause of the failure occurred. Then, remove the root cause.

Sequence of events in troubleshooting



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Checks before troubleshooting

	Item	Judgement value	Action
Lubricating oil, coolant	1. Check fuel level, type of fuel	—	Add fuel
	2. Check for impurities in fuel	—	Clean, drain
	3. Check for clogging of fuel filter cartridge	—	Replace
	4. Check engine oil level in oil pan, type of oil	—	Add oil
	5. Check for clogging of engine oil filter	—	Replace
	6. Check coolant level	—	Add coolant
	7. Check for clogging of air cleaner	—	Clean or replace
	8. Check hydraulic oil level, type of oil	—	Add oil
	9. Check for clogging of hydraulic oil strainer	—	Clean, drain
	10. Check for clogging of hydraulic oil filter	—	Replace
	11. Check swing machinery oil level, type of oil	—	Add oil
	12. Check final drive oil level, type of oil	—	Add oil
Electrical equipment	1. Check for looseness, corrosion of battery terminal, wiring	—	Tighten or replace
	2. Check for looseness, corrosion of alternator terminal, wiring	—	Tighten or replace
	3. Check for looseness, corrosion of starting motor terminal, wiring	—	Tighten or replace
Hydraulic, mechanical equipment	1. Check for abnormal noise, smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Carry out air bleeding	—	Bleed air
Electrics, electrical equipment	1. Check battery voltage (engine stopped)	10 – 15V	Charge or replace
	2. Check battery electrolyte level	—	Add or replace
	3. Check for discolored, burnt, exposed wiring	—	Replace
	4. Check for missing wiring clamps, hanging wiring	—	Repair
	5. Check for water leaking on wiring (be particularly careful attention to water leaking on connectors or terminals)	—	Disconnect connector and dry
	6. Check for blown, corroded fuses	—	Replace
	7. Check alternator voltage (engine running at 1/2 throttle or above)	After running for several minutes : 13.5 – 14.5V	Replace
	8. Check operating sound of battery relay (when switch is turned ON/OFF)	—	Replace

Classification and procedures of troubleshooting

Classification of troubleshooting

Mode	Contents
E-mode	Troubleshooting for electrical system
H-mode	Troubleshooting for hydraulic and mechanical system
S-mode	Troubleshooting for engine unit

Procedure for troubleshooting

If a possible fault is detected in the machine, find a corresponding fault in the table of "Possible faults and troubleshooting Nos.", then go to the indicated troubleshooting section.

Information contained in troubleshooting table

Action code	Failure code	Trouble	Problem that appears on machine
Monitor display	Monitor display		
Contents of trouble	State where the monitor panel or controller detects the trouble		
Action of controller	Action taken by machine monitor or controller to protect system or devices when engine controller detects trouble		
Problem that appears on machine	Problem that appears on machine as a result of action taken by machine monitor or controller (shown above)		
Related information	Information related to detected trouble or troubleshooting		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Possible causes of trouble is assumed to be detected (The order number indicates a serial number, not a priority sequence.)	<p><Described contents></p> <ul style="list-style-type: none"> Standard value in normal state to judge assumed cause (good or not) Remarks required to judge whether the cause is good <p><Phenomenon of defective wiring harness></p> <ul style="list-style-type: none"> Disconnection in wiring The connector connection is defective or the wiring harness is disconnected. Grounding fault A harness not connected to ground (earth) circuit comes into contact with the ground (earth) circuit. Hot short circuit A harness not connected to the power (24 V) circuit comes into contact with the power (24 V) circuit. Short circuit A harnesses of an independent circuit abnormally comes into contact with one of another circuit. <p><Notes on troubleshooting></p> <p>(1) Method of indicating connector number and handling T-branch For troubleshooting, insert or connect T-branch adapter as shown below unless especially specified.</p> <ul style="list-style-type: none"> When “male” or “female” is not indicated for a connector number, disconnect the connector, and insert the T-branch adapter in both the male and female. When “male” and “female” is indicated for a connector number, disconnect the connector, and insert the T-branch adapter in only either the male or female. <p>(2) Pin number description sequence and tester lead handling For troubleshooting, connect the plus (+) and minus (–) leads as shown below unless especially specified.</p> <ul style="list-style-type: none"> Connect the plus (+) lead to a pin or harness indicated in the front. Connect the minus (–) lead to a pin or harness indicated in the rear.
	2		
	3		
	4		

Related circuit diagram

This is the excerpted circuit diagram related to trouble

- Connector No.: Indicates (Model – No. of pins) (Color)
- “Connector No. and pin No.” from each branching/merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.
- Arrow (↔): Roughly shows the location on the machine.

Possible faults and troubleshooting Nos.

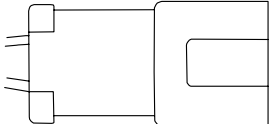
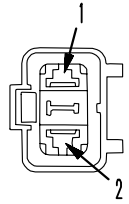
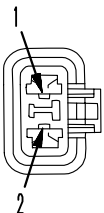
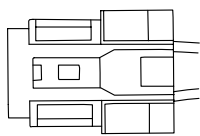
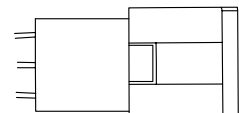
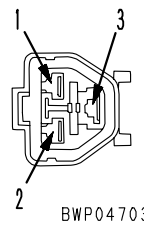
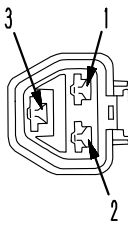
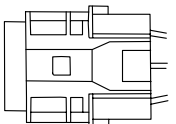
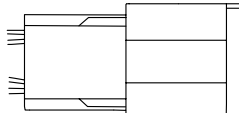
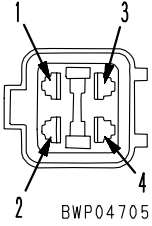
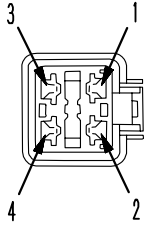
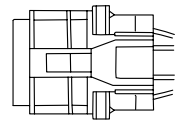
No.	Possible fault		Troubleshooting		
			E-mode	H-mode	S-mode
Possible faults related to engine					
1	Engine does not start easily (It always takes time to start)				S-1
2	Engine does not start	Engine does not crank	E-1		S-2
3		Engine cranks but exhaust smoke does not come out			S-2
4		Exhaust smoke comes out but engine does not start			S-2
5	Engine speed does not rise sharply (Follow-up performance is low)				S-3
6	Engine stops during operation				S-4
7	Engine rotation is abnormal (Engine hunts)				S-5
8	Output is insufficient or power is low				S-6
9	Exhaust gas color is bad (Incomplete combustion)				S-7
10	Oil is consumed much or exhaust gas color is bad				S-8
11	Oil becomes dirty quickly				S-9
12	Fuel is consumed much				S-10
13	Coolant contains oil, blows back, or reduces				S-11
14	Engine oil pressure caution lamp lights up (Oil pressure lowers)				S-12
15	Oil level rises (Water or fuel is mixed in oil)				S-13
16	Coolant temperature rises too high (Overheating)				S-14
17	Abnormal sound comes out				S-15
18	Vibration is excessive				S-16
19	Engine does not stop		E-2		
20	Engine is not preheated normally		E-8		
Possible faults related to work equipment, travel, swing, and blade					
21	Speed or power of whole work equipment, travel, swing, and blade is low			H-1	
22	Engine speed lowers extremely or engine stalls			H-2	
23	Work equipment, travel, swing, and blade systems do not work			H-3	
24	Abnormal sound comes out from around hydraulic pump			H-4	
25	Fine control performance or response is low			H-5	
Possible faults related to work equipment					
26	When work equipment lock lever is set in LOCK position, work equipment still moves		E-14		
27	Speed or power of boom is low			H-6	
28	Speed or power of arm is low			H-7	
29	Speed or power of bucket is low			H-8	
30	Speed or power of boom swing is low			H-9	
31	Work equipment does not move singly			H-10	
32	Hydraulic drift of work equipment is large			H-11	
33	Time lag of work equipment is large			H-12	

No.	Possible fault	Troubleshooting		
		E-mode	H-mode	S-mode
34	In compound operation of work equipment, speed of part loaded more is low		H-13	
Possible faults related to travel				
35	Machine deviates during travel		H-14	
36	Speed or power of travel is low (While work equipment operates normally)		H-15	
37	Machine is not steered well or steering power is low		H-16	
38	Travel speed does not change		H-17	
39	Travel motor does not work		H-18	
Possible faults related to swing				
40	Speed or power of swing is low		H-19	
41	Machine does not swing		H-20	
42	Swing acceleration is low		H-21	
43	Machine overruns when it stops swinging		H-22	
44	Large shock is made when machine stops swinging		H-23	
45	Large sound is made when machine stops swinging		H-24	
46	Hydraulic drift of swing is large		H-25	
Possible fault related to blade				
47	Speed or power of blade is low		H-26	
48	Blade does not move		H-27	
49	Hydraulic drift of blade is large		H-28	
Possible fault related to monitor panel				
50	When starting switch is turned ON, any item does not operate	E-3		
51	When starting switch is turned ON, some items do not operate	E-4		
52	Alarm buzzer is abnormal	E-5		
53	Engine oil pressure caution is turned ON	E-6		
54	Charge level caution is turned ON	E-7		
55	Preheating system does not operate or preheater does not become hot	E-8		
56	Coolant temperature gauge is abnormal	E-9		
57	Fuel level gauge is abnormal	E-10		
58	Service meter does not operate while engine is running	E-11		
59	2nd travel speed is not selected	E-12		
60	Working lamp does not light up	E-13		
Other possible faults				
61	Windshield wiper does not operate	E-15		
62	Windshield washer does not operate	E-16		
63	Defective air conditioner	E-17		

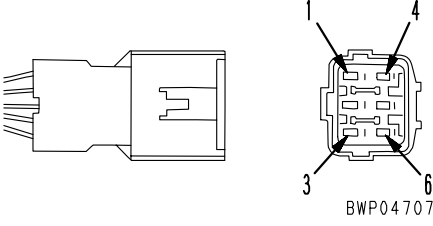
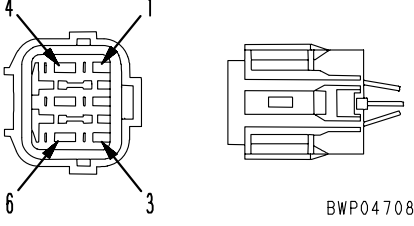
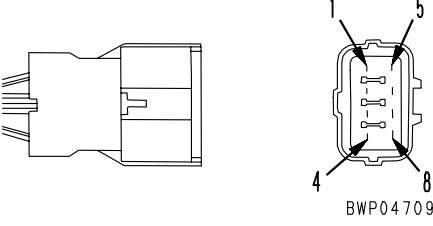
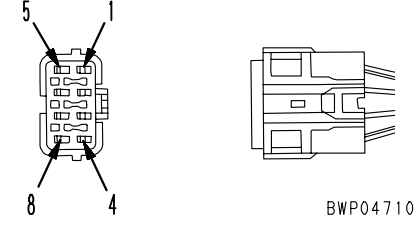
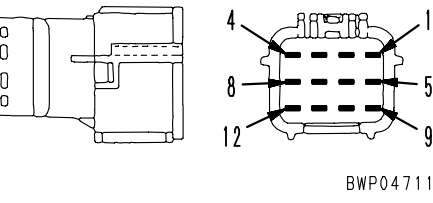
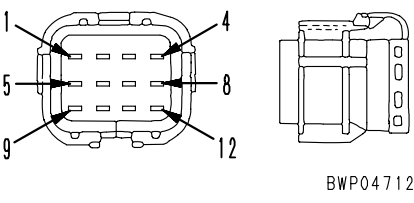
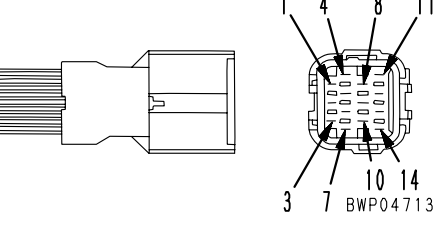
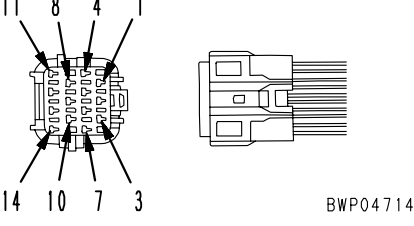
Connection table for connector pin numbers

(Rev. 2007.12)

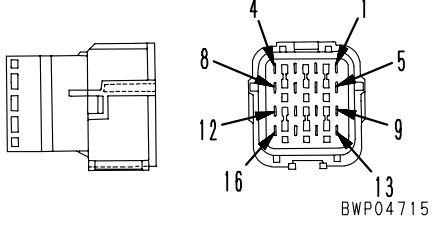
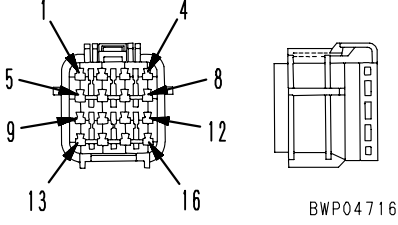
★ The terms of male and female refer to the pins, while the terms of male housing and female housing refer to the mating portion of the housing.

No. of pins	X type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No. : 08055-00181	Part No. : 08055-00191	799-601-7010
2	  BWP04701	  BWP04702	799-601-7020
	Part No. : 08055-00282	Part No. : 08055-00292	
3	  BWP04703	  BWP04704	799-601-7030
	Part No. : 08055-00381	Part No. : 08055-00391	
4	  BWP04705	  BWP04706	799-601-7040
	Part No. : 08055-00481	Part No. : 08055-00491	
—	Terminal part No. : 79A-222-3370 ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	Terminal part No. : 79A-222-3390 ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	—
—	Terminal part No. : 79A-222-3380 ·Electric wire size: 2.0 ·Grommet:Red ·Q'ty: 20	Terminal part No. : 79A-222-3410 ·Electric wire size: 2.0 ·Grommet:Red ·Q'ty: 20	—

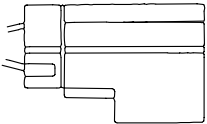

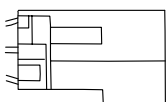
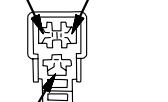

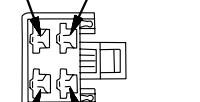
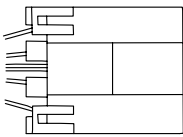
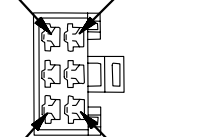
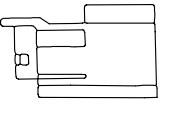
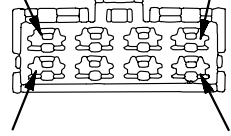
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No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
6	 <p>BWP04707</p>	 <p>BWP04708</p>	799-601-7050
	Part No. : 08055-10681	Part No. : 08055-10691	
8	 <p>BWP04709</p>	 <p>BWP04710</p>	799-601-7060
	Part No. : 08055-10881	Part No. : 08055-10891	
12	 <p>BWP04711</p>	 <p>BWP04712</p>	799-601-7310
	Part No. : 08055-11281	Part No. : 08055-11291	
14	 <p>BWP04713</p>	 <p>BWP04714</p>	799-601-7070
	Part No. : 08055-11481	Part No. : 08055-11491	

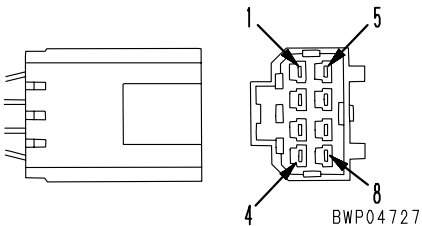
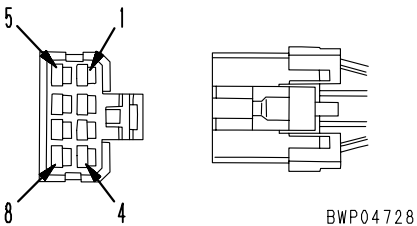
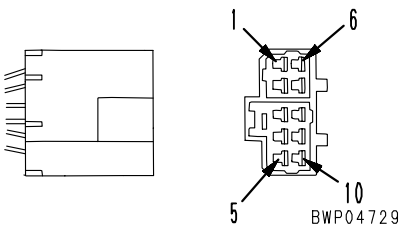
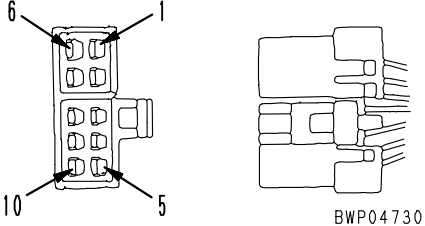
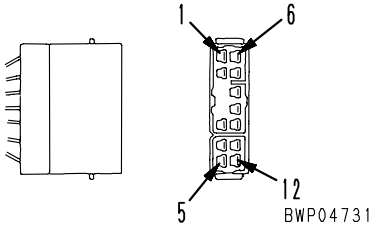
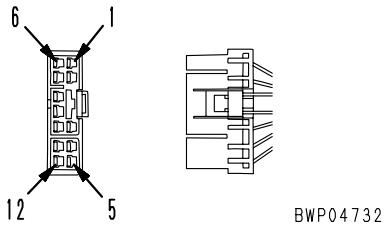
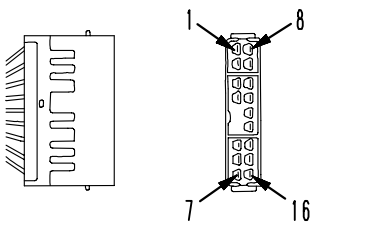
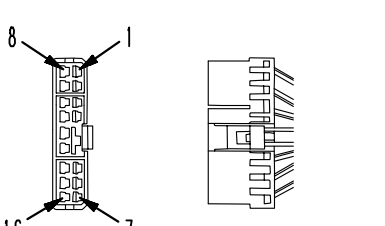
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No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
16	 BWP04715	 BWP04716	799-601-7320
	Part No. : 08055-11681	Part No. : 08055-11691	
—	Terminal part No. : ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	Terminal part No. : ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	—
—	Terminal part No. : ·Electric wire size: 1.25 ·Grommet:Red ·Q'ty: 20	Terminal part No. : ·Electric wire size: 1.25 ·Grommet:Red ·Q'ty: 20	—

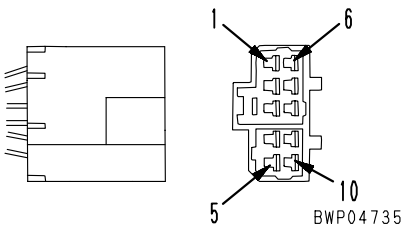
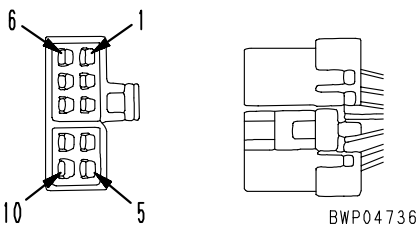
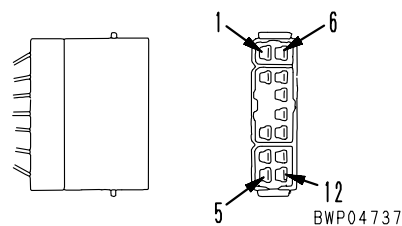
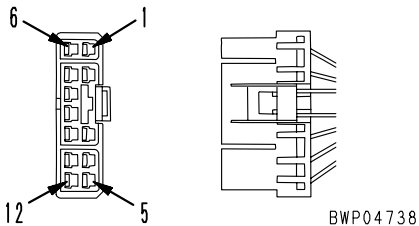
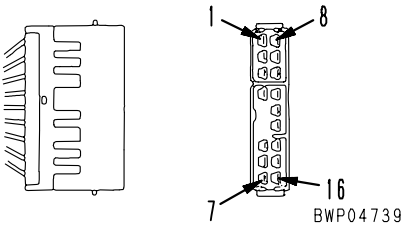
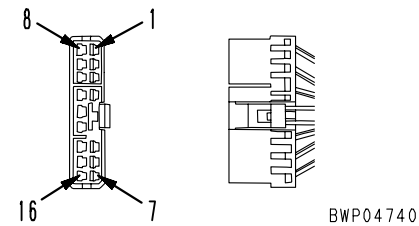
9JS04892

No. of pins	M type connector		
	Male (female housing)	Female (male housing)	T-adaptor Part No.
1	Part No. : 08056-00171	Part No. : 08056-00181	799-601-7080
2	 BWP04717	 BWP04718	799-601-7090
	Part No. : 08056-00271	Part No. : 08056-00281	
3	 BWP04719	 BWP04720	799-601-7110
	Part No. : 08056-00371	Part No. : 08056-00381	
4	 BWP04721	 BWP04722	799-601-7120
	Part No. : 08056-00471	Part No. : 08056-00481	
6	 BWP04723	 BWP04724	799-601-7130
	Part No. : 08056-00671	Part No. : 08056-00681	
8	 BWP04725	 BWP04726	799-601-7340
	Part No. : 08056-00871	Part No. : 08056-00881	

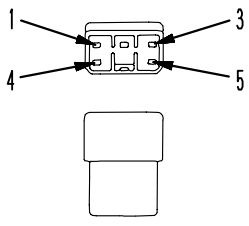
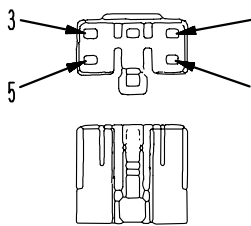
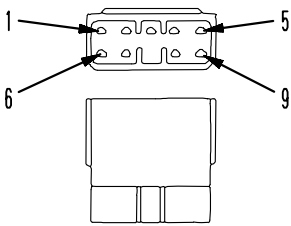
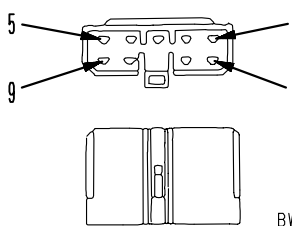
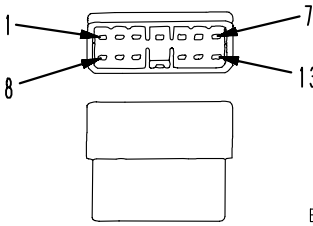
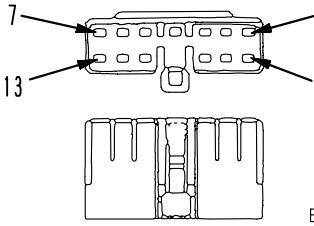
9JS04893

No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 BWP04727	 BWP04728	799-601-7140
	Part No. : 08056-10871	Part No. : 08056-10881	
10 (White)	 BWP04729	 BWP04730	799-601-7150
	Part No. : 08056-11071	Part No. : 08056-11081	
12 (White)	 BWP04731	 BWP04732	799-601-7350
	Part No. : 08056-11271	Part No. : 08056-11281	
16 (White)	 BWP04733	 BWP04734	799-601-7330
	Part No. : 08056-11671	Part No. : 08056-11681	

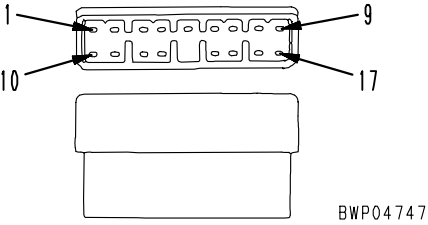
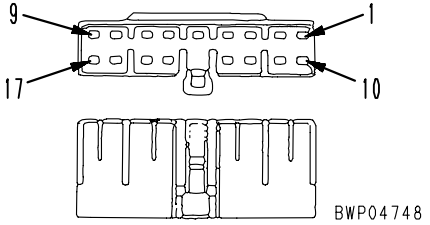
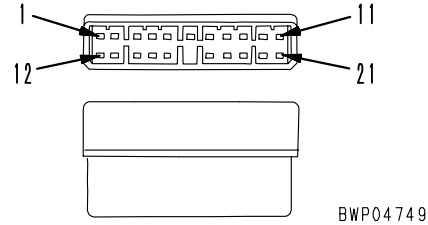
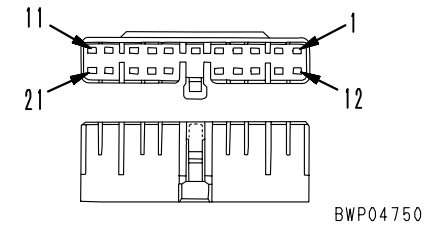
9JS04894

No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160
	Part No. : 08056-11272	Part No. : 08056-11282	
16 (Blue)			799-601-7170
	Part No. : 08056-11672	Part No. : 08056-11682	

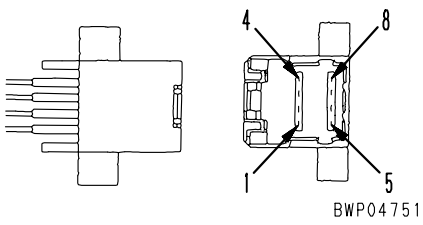
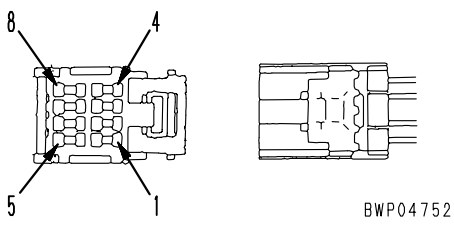
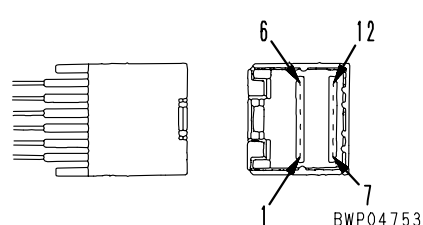
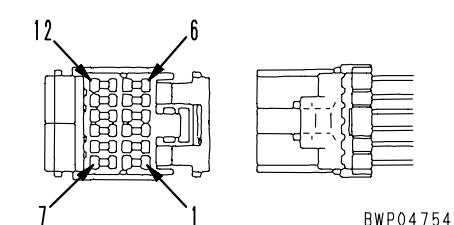
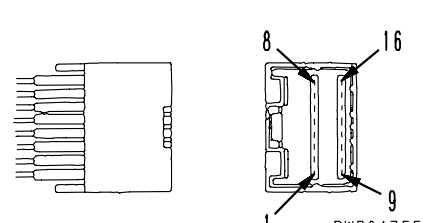
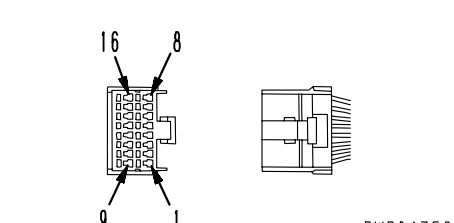
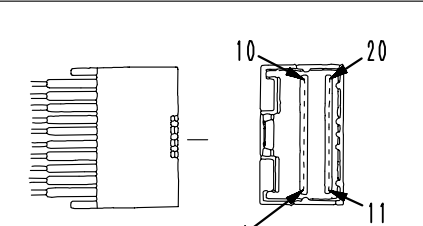
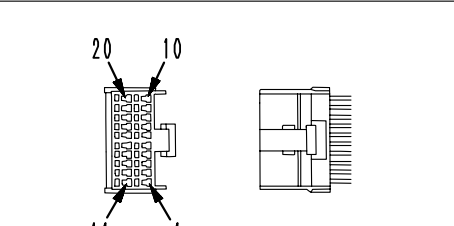
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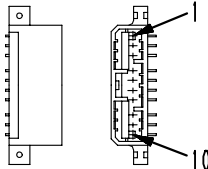
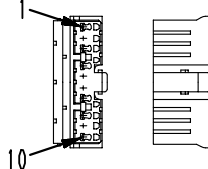
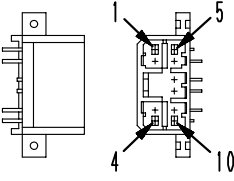
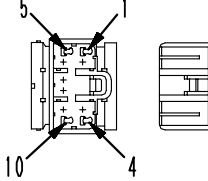
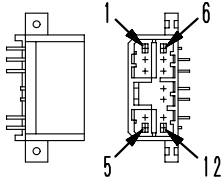
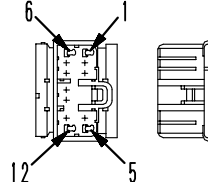
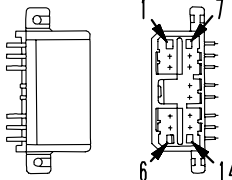
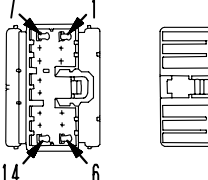
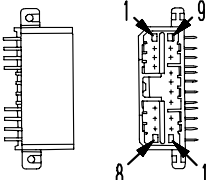
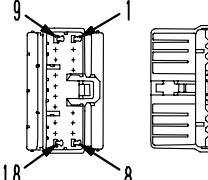
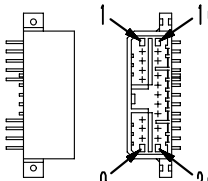
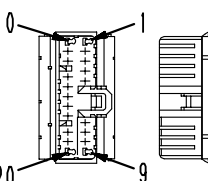
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
7	Body part No. : 79A-222-2640 (Q' ty:5)	Body part No. : 79A-222-2630 (Q' ty:5)	—
11	Body part No. : 79A-222-2680 (Q' ty:5)	Body part No. : 79A-222-2670 (Q' ty:5)	—
5	 <p>BWP04741</p>	 <p>BWP04742</p>	799-601-2710
	Body part No. : 79A-222-2620 (Q' ty:5)	Body part No. : 79A-222-2610 (Q' ty:5)	
9	 <p>BWP04743</p>	 <p>BWP04744</p>	799-601-2950
	Body part No. : 79A-222-2660 (Q' ty:5)	Body part No. : 79A-222-2650 (Q' ty:5)	
13	 <p>BWP04745</p>	 <p>BWP04746</p>	799-601-2720
	Body part No. : 79A-222-2710 (Q' ty:2)	Body part No. : 79A-222-2690 (Q' ty:2)	

9JS04896

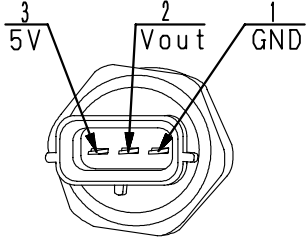
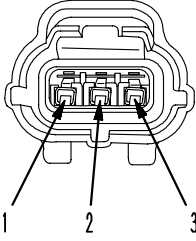
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17	 <p>BWP04747</p>	 <p>BWP04748</p>	799-601-2730
	Body part No. : 79A-222-2730 (Q' ty:2)	Body part No. : 79A-222-2720 (Q' ty:2)	
21	 <p>BWP04749</p>	 <p>BWP04750</p>	799-601-2740
	Body part No. : 79A-222-2750 (Q' ty:2)	Body part No. : 79A-222-2740 (Q' ty:2)	
	Terminal part No. : 79A-222-2770 (Q' ty:50)	Terminal part No. : 79A-222-2760 (Q' ty:50)	

9JS04897

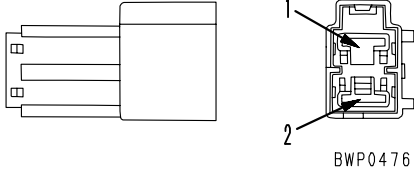
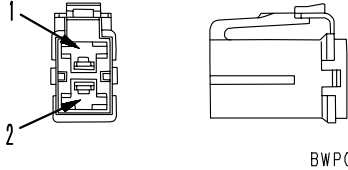
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 BWP04751	 BWP04752	799-601-7180
	—	Housing part No. : 79A-222-3430 (Q' ty:5)	
12	 BWP04753	 BWP04754	799-601-7190
	—	Housing part No. : 79A-222-3440 (Q' ty:5)	
16	 BWP04755	 BWP04756	799-601-7210
	—	Housing part No. : 79A-222-3450 (Q' ty:5)	
20	 BWP04757	 BWP04758	799-601-7220
	—	Housing part No. : 79A-222-3460 (Q' ty:5)	
★ Terminal part No. : 79A-222-3470 (No relation with number of pins)			
9JS04898			

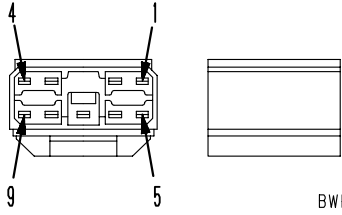
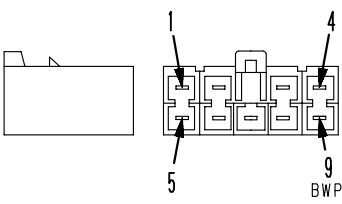
No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04759	 BWP04760	—
	—	—	
10	 9JS02245	 9JS02246	799-601-7510
	—	Part No. : 7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520
	—	Part No. : 7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530
	—	Part No. : 7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540
	—	Part No. : 7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550
	—	Part No. : 7821-92-7370	

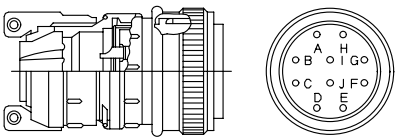
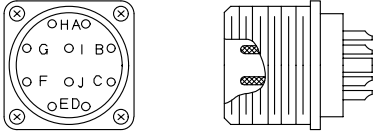
BJH13186

AMP connetor			
No. of pins	Oil pressure sensor		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-9420 (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

BJH13195

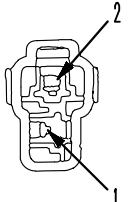
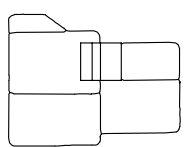
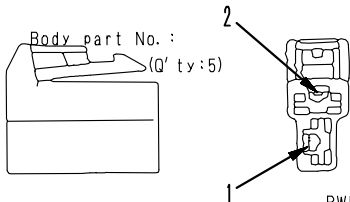
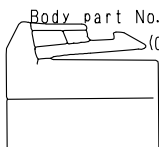
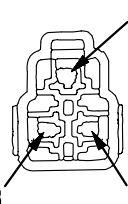
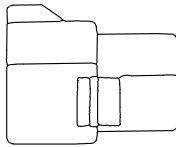
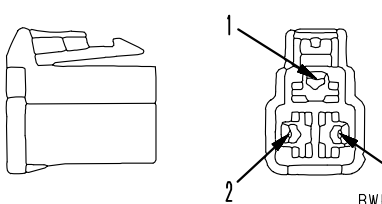

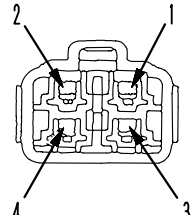
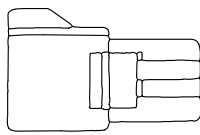
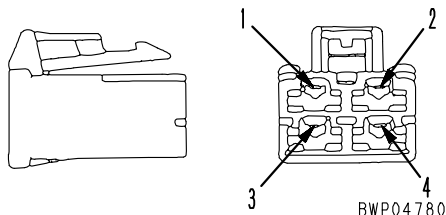
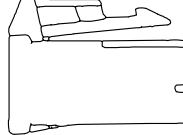
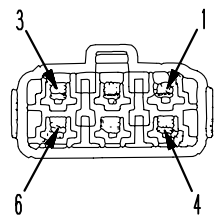
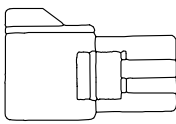
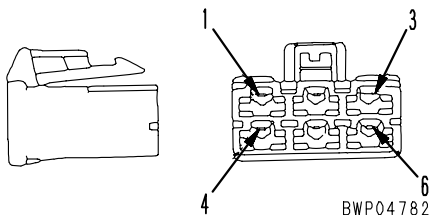
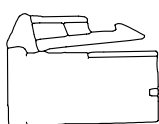
L type connector			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
	—	—	

Connector for PA			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
	—	—	

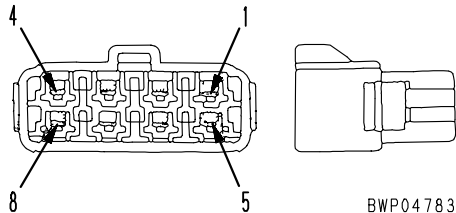
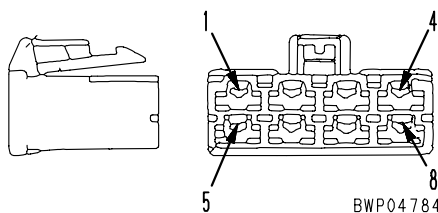
Bendix MS connector			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

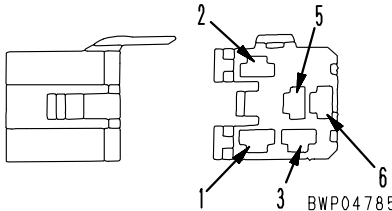
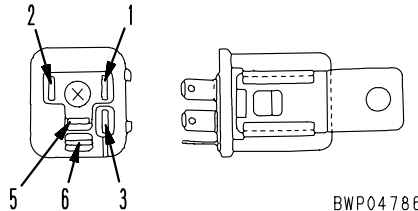
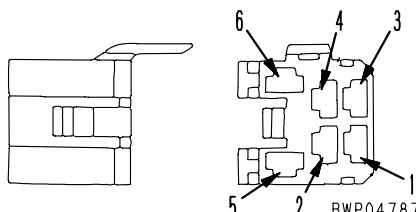
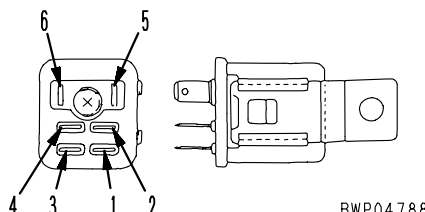
9JS04900

9JS04900

No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	  <p>BWP04775</p>	  <p>BWP04776</p>	—
	Part No. : 08027-10210 (Natural color) 08027-10220 (Black)	Part No. : 08027-10260 (Natural color) 08027-10270 (Black)	
3	  <p>BWP04777</p>	  <p>BWP04778</p>	—
	Part No. : 08027-10310	Part No. : 08027-10360	
4	  <p>BWP04779</p>	  <p>BWP04780</p>	—
	Part No. : 08027-10410 (Natural color) 08027-10420 (Black)	Part No. : 08027-10460 (Natural color) 08027-10470 (Black)	
6	  <p>BWP04781</p>	  <p>BWP04782</p>	—
	Part No. : 08027-10610 (Natural color) 08027-10620 (Black)	Part No. : 08027-10660 (Natural color) 08027-10670 (Black)	

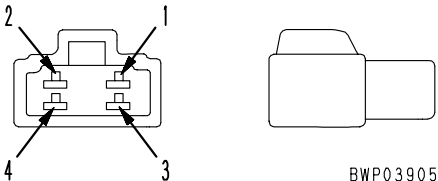
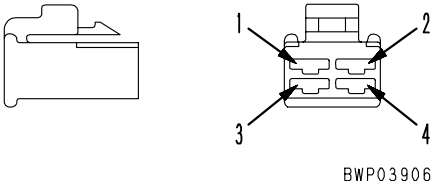
9JS04901

No. of pins	KES1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 <p>BWP04783</p>	 <p>BWP04784</p>	—
	Part No. :08027-10810 (Natural color) 08027-10820 (Black)	Part No. :08027-10860 (Natural color) 08027-10870 (Black)	

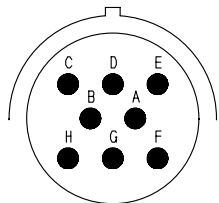
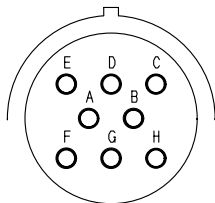
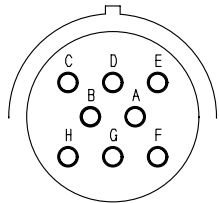
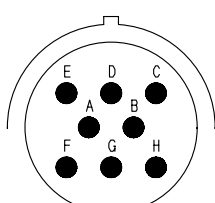
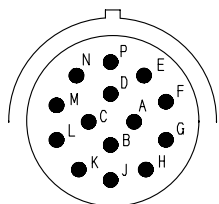
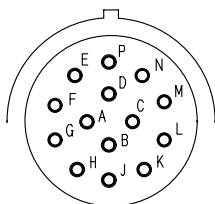
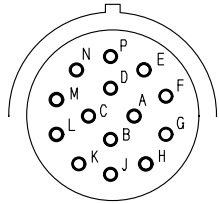
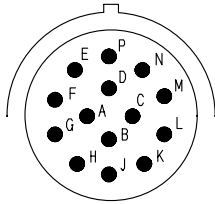
No. of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5	 <p>BWP04785</p>	 <p>BWP04786</p>	799-601-7360
	—	—	
6	 <p>BWP04787</p>	 <p>BWP04788</p>	799-601-7370
	—	—	

9JS04902

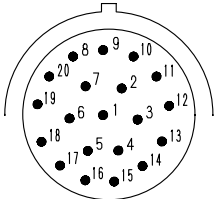
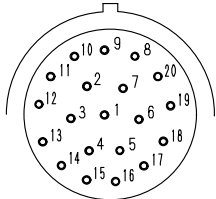
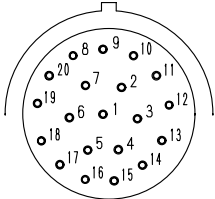
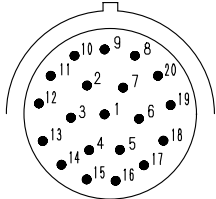
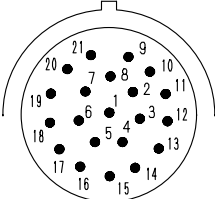
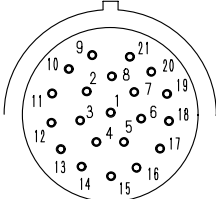
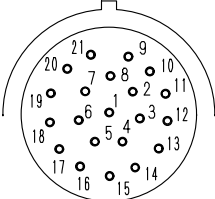
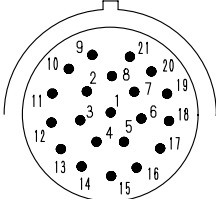
9JS04902

No. of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	 BWP03905	 BWP03906	—
	—	—	

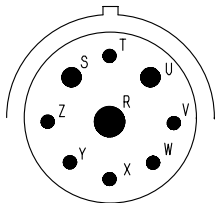
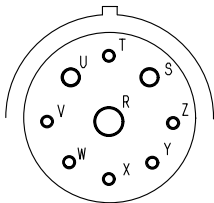
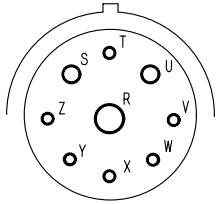
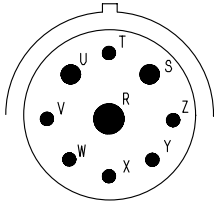
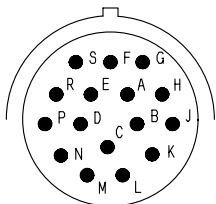
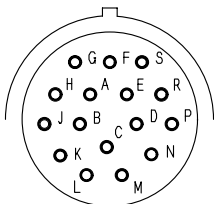
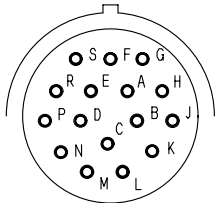
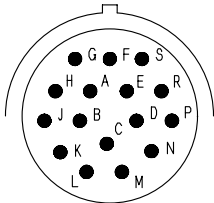
9JS04903

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-8 (1)	Pin (male terminal)	Socket (female terminal)	799-601-9210
	 BWP05001	 BWP05002	
	Part No. : 08191-11201, 08191-11202, 08191-11205, 08191-11206	Part No. : 08191-14101, 08191-14102, 08191-14105, 08191-14106	799-601-9210
	Socket (female terminal)	Pin (male terminal)	
18-14 (2)	 BWP05003	 BWP05004	799-601-9220
	Part No. : 08191-12201, 08191-12202, 08191-12205, 08191-12206	Part No. : 08191-13101, 08191-13102, 08191-13105, 08191-13106	
	Pin (male terminal)	Socket (female terminal)	799-601-9220
	 BWP05005	 BWP05006	
	Part No. : 08191-21201, 08191-22202, 08191-21205, 08191-22206	Part No. : 08191-24101, 08191-24102, 08191-24105, 08191-24106	799-601-9220
	Socket (female terminal)	Pin (male terminal)	
	 BWP05007	 BWP05008	
	Part No. : 08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No. : 08191-23101, 08191-23102, 08191-23105, 08191-23106	

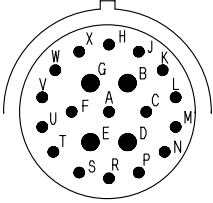
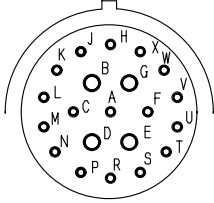
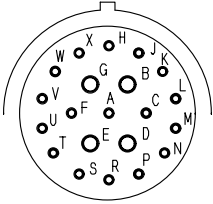
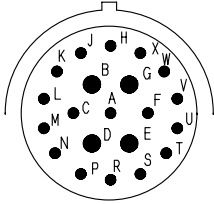
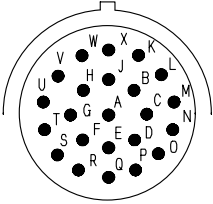
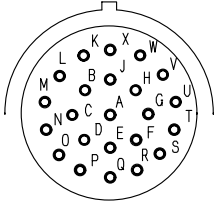
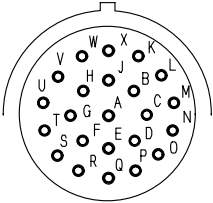
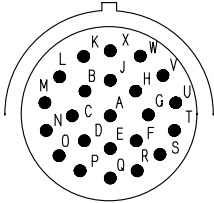
9JS04904

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-20 (3)	Pin (male terminal)	Socket (female terminal)	799-601-9230
	 <p>BWP05009</p>	 <p>BWP05010</p>	
	Part No. :08191-31201, 08191-31202	Part No. :08191-34101, 08191-34102	799-601-9230
	Socket (female terminal)	Pin (male terminal)	
	 <p>BWP05011</p>	 <p>BWP05012</p>	
	Part No. :08191-32201, 08191-32202	Part No. :08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Socket (female terminal)	799-601-9240
	 <p>BWP05013</p>	 <p>BWP05014</p>	
	Part No. :08191-41201, 08191-42202	Part No. :08191-44101, 08191-44102	799-601-9240
	Socket (female terminal)	Pin (male terminal)	
	 <p>BWP05015</p>	 <p>BWP05016</p>	
	Part No. :08191-42201, 08191-42202	Part No. :08191-43101, 08191-43102	

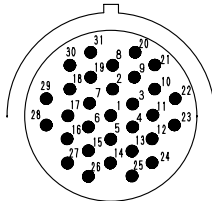
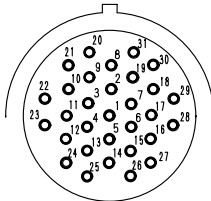
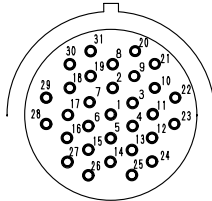
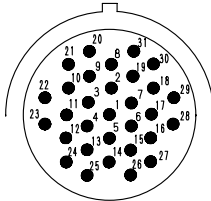
9JS04905

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
24-9 (5)	Pin (male terminal)	Socket (female terminal)	799-601-9250
	 BWP05017	 BWP05018	
	Part No. : 08191-51201, 08191-51202	Part No. : 08191-54101, 08191-54102	799-601-9250
	Socket (female terminal)	Pin (male terminal)	
24-16 (6)	 BWP05019	 BWP05020	799-601-9260
	Part No. : 08191-52201, 08191-52202	Part No. : 08191-53101, 08191-53102	
	Pin (male terminal)	Socket (female terminal)	799-601-9260
	 BWP05021	 BWP05022	
24-16 (6)	Part No. : 08191-61201, 08191-62202, 08191-61205, 08191-62206	Part No. : 08191-64101, 08191-64102, 08191-64105, 08191-64106	799-601-9260
	Socket (female terminal)	Pin (male terminal)	
	 BWP05023	 BWP05024	799-601-9260
	Part No. : 08191-62201, 08191-62202, 08191-62205, 08191-62206	Part No. : 08191-63101, 08191-63102, 08191-63105, 08191-63106	

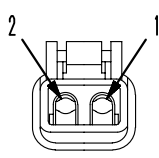
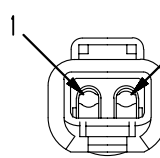
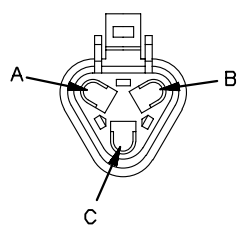
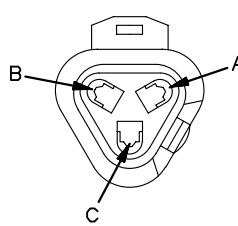
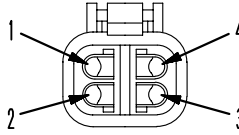
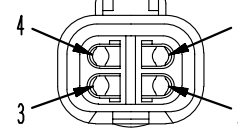
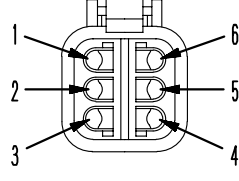
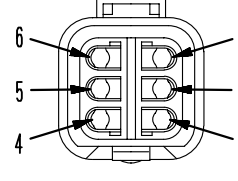
9JS04906

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
24-21 (7)	Pin (male terminal)	Socket (female terminal)	799-601-9270
	 BWP05025	 BWP05026	
	Part No. : 08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No. : 08191-74101, 08191-74102, 08191-74105, 08191-74106	
	Socket (female terminal)	Pin (male terminal)	799-601-9270
	 BWP05027	 BWP05028	
	Part No. : 08191-72201, 08191-72202, 08191-72205, 08191-72206	Part No. : 08191-73101, 08191-73102, 08191-73105, 08191-73106	
24-23 (8)	Pin (male terminal)	Socket (female terminal)	799-601-9280
	 BWP05029	 BWP05030	
	Part No. : 08191-81201, 08191-81202, 08191-81203, 08191-81204, 08191-81205, 08191-80206	Part No. : 08191-84101, 08191-84102, 08191-84103, 08191-84104, 08191-84105, 08191-84106	
	Socket (female terminal)	Pin (male terminal)	799-601-9280
	 BWP05031	 BWP05032	
	Part No. : 08191-82201, 08191-82202, 08191-82203, 08191-82204, 08191-82205, 08191-82206	Part No. : 08191-83101, 08191-83102, 08191-83103, 08191-83104, 08191-83105, 08191-83106	

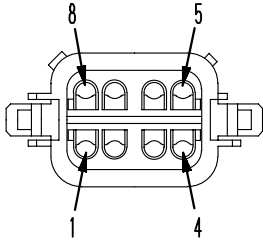
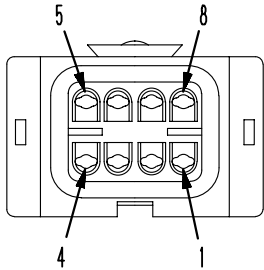
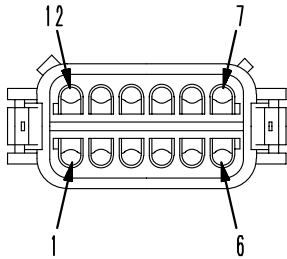
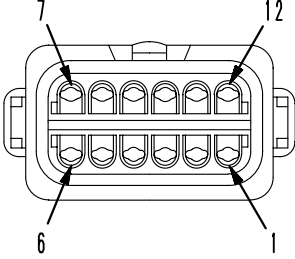
9JS04907

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-31 (9)	Pin (male terminal)	Socket (female terminal)	799-601-9290
	 BWP05033	 BWP05034	
	Part No. : 08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No. : 08191-94103, 08191-94104, 08191-94105, 08191-94106	
	Socket (female terminal)	Pin (male terminal)	799-601-9290
	 BWP05035	 BWP05036	
	Part No. : 08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. : 08191-93103, 08191-93104, 08191-93105, 08191-93106	

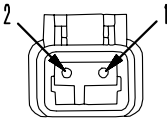
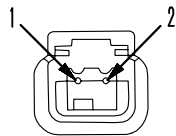
9JS04908

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
2	 BWP05037	 BWP05038	799-601-9020 799-601-9890
	Part No. : 08192-12200 (normal type) 08192-22200 (fine wire type)	Part No. : 08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 BWP05039	 BWP05040	799-601-9030 799-601-9890
	Part No. : 08192-1A200 (normal type) 08192-2A200 (fine wire type)	Part No. : 08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 BWP05041	 BWP05042	799-601-9040 799-601-9890
	Part No. : 08192-14200 (normal type) 08192-24200 (fine wire type)	Part No. : 08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 BWP05043	 BWP05044	799-601-9050
	Part No. : 08192-16200 (normal type) 08192-26200 (fine wire type)	Part No. : 08192-16100 (normal type) 08192-26100 (fine wire type)	

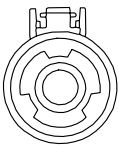
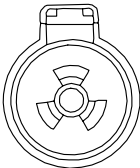
B3D15085

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
8	 <p>BWP05045</p>	 <p>BWP05046</p>	8GR: 799-601-9060 8B: 799-601-9070 8G: 799-601-9080 8BR: 799-601-9090
	Part No. : 08192-1820□ (normal type) 08192-2820□ (fine wire type)	Part No. : 08192-1810□ (normal type) 08192-2810□ (fine wire type)	
12	 <p>BWP05047</p>	 <p>BWP05048</p>	12GR: 799-601-9110 12B: 799-601-9120 12G: 799-601-9130 12BR: 799-601-9140
	Part No. : 08192-1920□ (normal type) 08192-2920□ (fine wire type)	Part No. : 08192-1910□ (normal type) 08192-2910□ (fine wire type)	

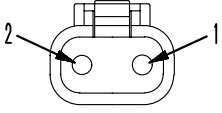
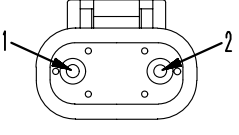
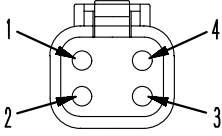
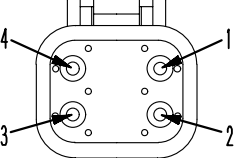
9JS04910

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05049	 BWP05050	799-601-9010 799-601-9890
	Part No. :08192-02200	Part No. :08192-02100	

B3D15086

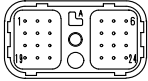
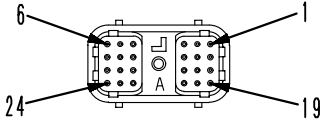
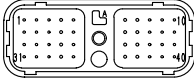
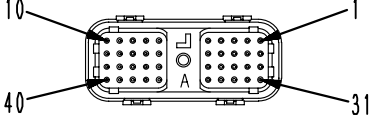
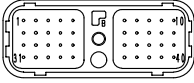
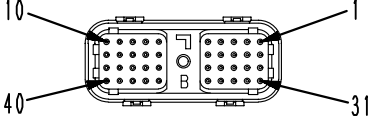
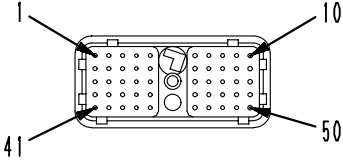
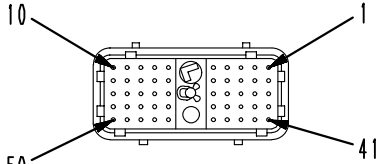
[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 BWP05051	 BWP05052	—
	Part No. :08192-31200 (Contact size #12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No. :08192-31100 (Contact size #12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

9JS04912

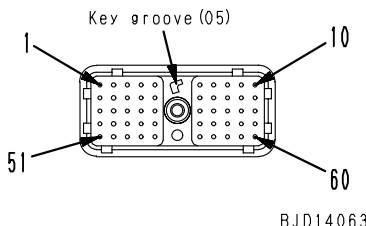
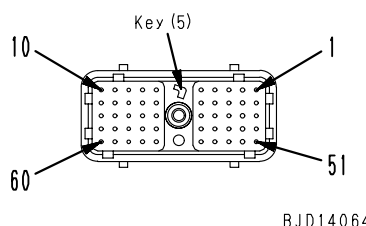
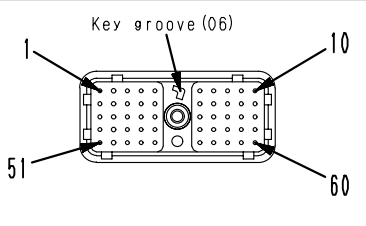
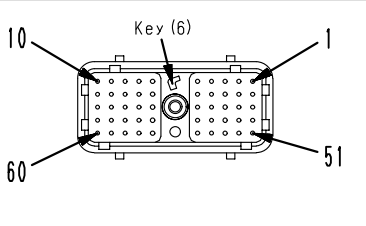
[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTP Series connector		
	Body (plug)	Body (receptacle)	T-adapter part No.
	Pin (female terminal)	Socket (male terminal)	
2			—
	—	—	
4			799-601-4260
	Part No. :6261-81-2810	—	

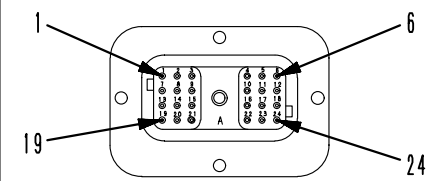
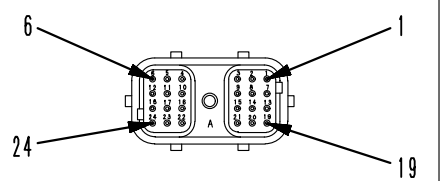
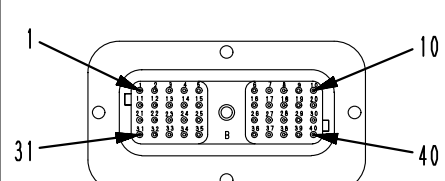
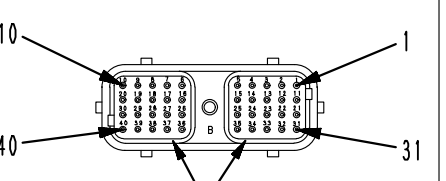
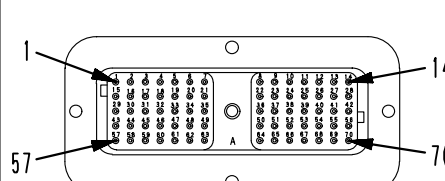
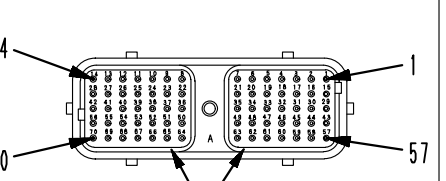
B3D15084

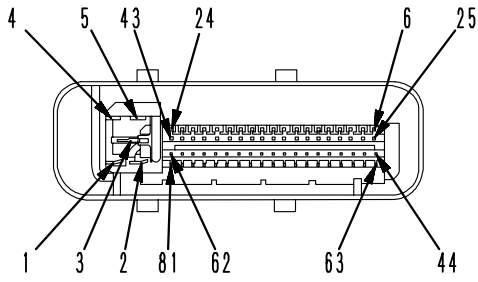
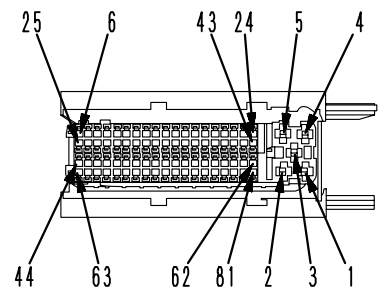
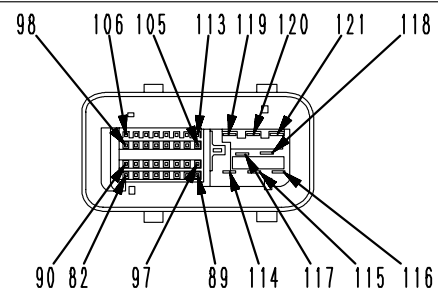
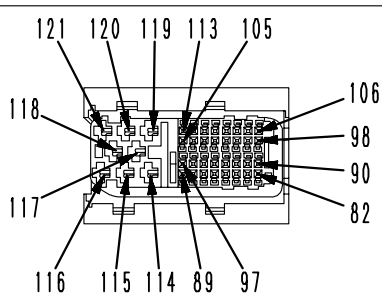
[The pin No. is also marked on the connector (electric wire insertion end)]

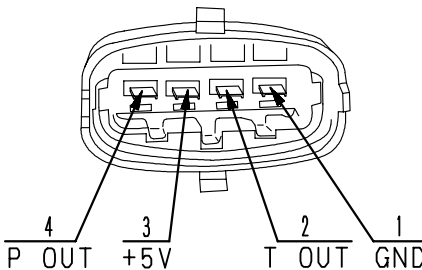
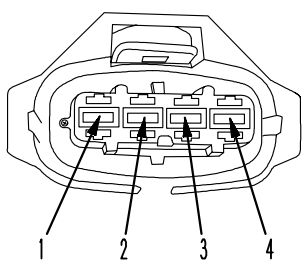
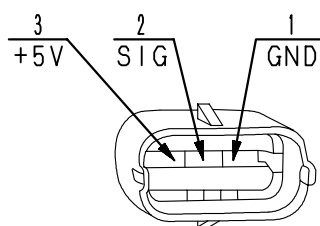
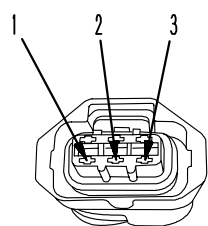
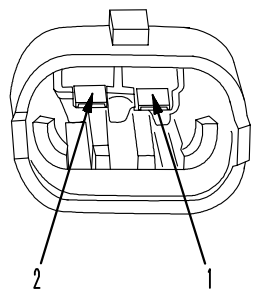
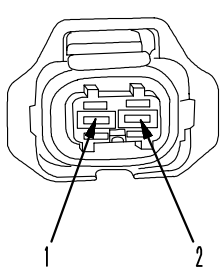
No. of pins	DRC26 Series connector		
	Male pin (female housing)	Female pin (male housing)	T-adapter Part No.
24	 BJD12722	 BJD12723	799-601-9360 (Kit:799-601-9300)
	—	Part No. :08194-01101	
40 (A)	 BJD12724	 BJD12725	799-601-9350 (Kit:799-601-9300)
	—	Part No. :08194-02101	
40 (B)	 BJD12726	 BJD12727	799-601-9350 (Kit:799-601-9300)
	—	Part No. :08194-02102	
50	 9JS02951	 9JS02952	799-601-4211 (Kit:799-601-4101)
	—	Part No. :08194-03103	

BJH13184

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DRC26 Series connector		
	Male pin (female housing)	Female pin (male housing)	T-adapter Part No.
60 -05※			799-601-4220 (Kit:799-601-4101)
	—	Part No. 08194-04104	
	※ -05:Key position		
60 -06※			Socket Part No. 799-601-4390
	—	—	
	※ -06:Key position		
BJH13185			

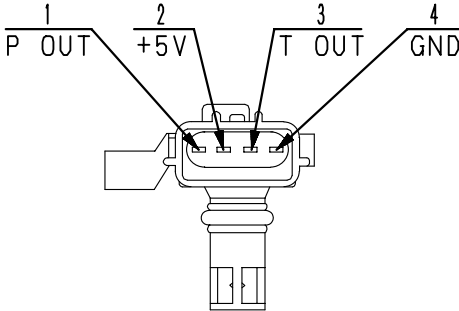
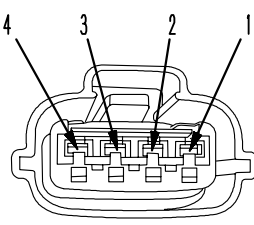
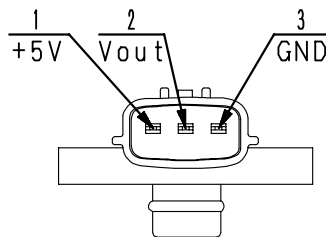
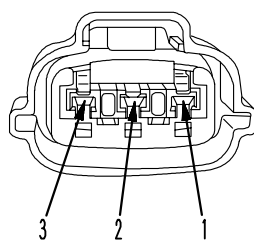
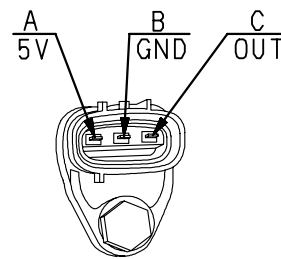
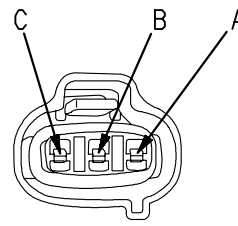
[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DRC12, 16 Series connector		
	DRC12:Male pin (female housing)	DRC16:Female pin (male housing)	T-adapter Part No.
24 (A)※ (B) (C)			-
	-	-	
40 (A)※ (B) (C)			-
	-	Seal (S) Part No. : 17A-06-41830	
70 (A)※ (B) (C)			-
	-	Seal (S) Part No. : 17A-06-41840	
※ (A)、(B)、(C) :Key position			
BJW12753			

AMP connector for pump controller (CH700)		
No. of pins	PC200/220-8, PC270-8, PC300-8, PC400-8, PC128/138US-8 and so on	T-adapter Part No.
	Controller side (plug)	
81		799-601-4280
	—	
	Harness side (receptacle) 	
40	Part No. : 7880-70-9040	BJH13174
	Controller side (plug)	
		
40	—	BJH13174
	Harness side (receptacle)	
		
40	Part No. : 7880-70-9010	

BOSCH connector for engine			
No. of pins	Boost (air intake) pressure and temperature sensor (95 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-4380
	—	—	
No. of pins	Common rail (fuel) pressure sensor (95, 107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4190 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	
No. of pins	Fuel supply pump (95, 107 engine) and fuel injector (95 engine)		
	Valve side (plug)	Harness side (receptacle)	T-adapter Part No.
2			799-601-4340 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

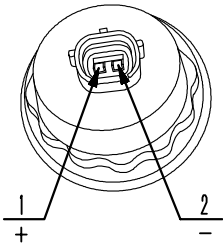
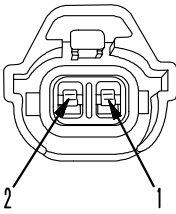
BJH13175

BJH13175

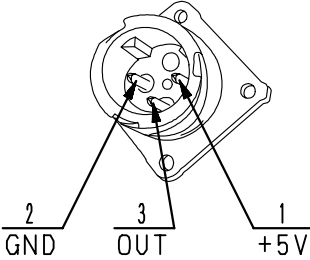
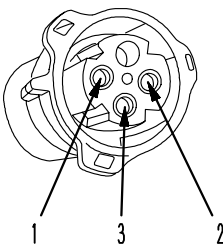
SUMITOMO connector for engine			
No. of pins	Boost (air intake) pressure and temeprature sensor (107,114 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-4230 (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	
No. of pins	Boost (air intake) pressure sensor (125,170,12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4250 (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	
No. of pins	G sensor (fuel supply pump speed sensor) (125,140,170,12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4330 (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

BJH1317

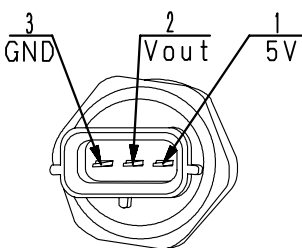
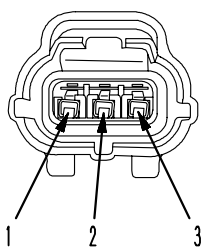
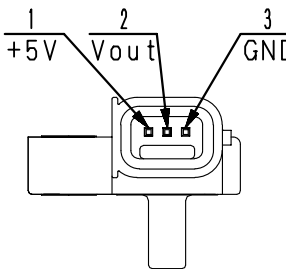
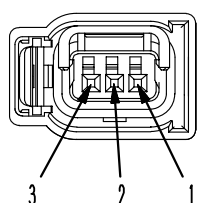
BJH13176

SUMITOMO connector for engine			
No. of pins	PCV (125, 140, 170, 12V140 engine)		
	Valve side (plug)	Harness side (receptacle)	T-adapter Part No.
2			799-601-9430 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

BJH13177

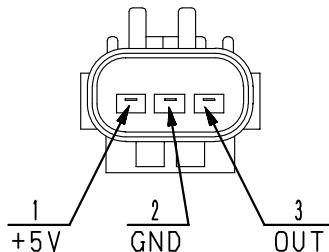
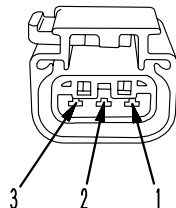
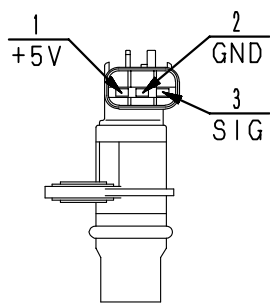
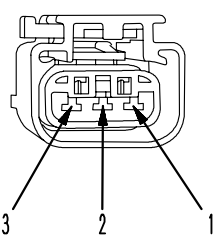
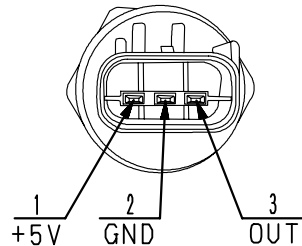
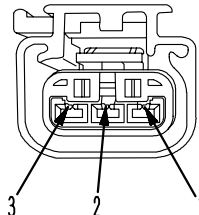
CANNON connector for engine			
No. of pins	Boost (air intake) pressure sensor (140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-4110 (Kit: 799-601-4101) (Kit: 799-601-4201)
	☆ Without pin (4)	☆ Without pin (4)	

BJH13178

AMP connector for engine			
No. of pins	Common rail (fuel) pressure sensor (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-9420 (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	
No. of pins	Ambient pressure sensor (95, 125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4240 (Kit:799-601-4101) (Kit:799-601-4201)
	—	—	

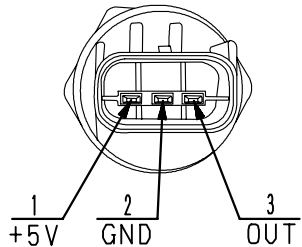
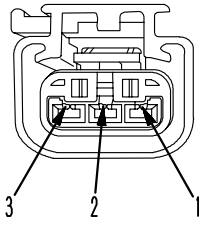
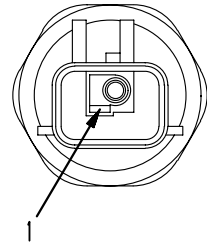
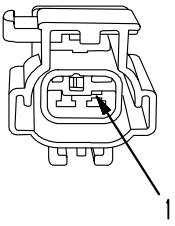
BJH13194

BJH13194

FRAMATOME connector for engine			
No. of pins	Ambient pressure sensor (107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4140 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	
No. of pins	NE speed sensor (95, 107, 114, 125, 140, 170, 12V140 engine) and CAM sensor (95, 107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4130 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	
No. of pins	EGR gas pressure sensor (125, 140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4180 (Kit: 799-601-4101) (Kit: 799-601-4201)
	—	—	

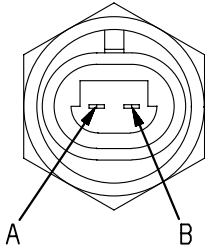
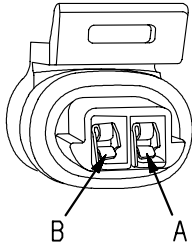
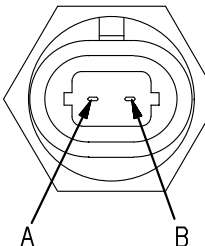
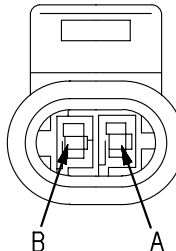
BJH13180

BJH13180

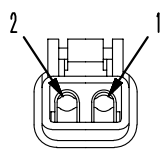
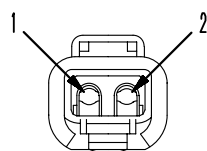
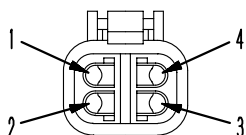
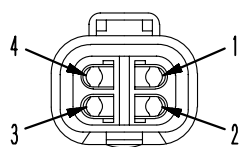
FRAMATOME connector for engine			
No. of pins	Lubricating oil pressure sensor (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4150 (Kit: 799-601-4101) (Kit: 799-601-4201)
	-	-	
No. of pins	Hydraulic switch (95, 107, 114 engine)		
	Switch side (plug)	Harness side (receptacle)	T-adapter Part No.
2			799-601-4160 (Kit: 799-601-4101) (Kit: 799-601-4201)
	☆ Without pin (2)	☆ Without pin (2)	

BJH13181

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PACKARD connceter for engine			
No. of pins	Temperature sensor of coolant, fuel and lubricating oil (95, 107, 114, 125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
2			795-799-5530 (Kit: 799-601-4101) (Kit: 799-601-4201)
	☆ Non-polarity	—	
No. of pins	Boost (air intake) temperature sensor (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
2			795-799-5540 (Kit: 799-601-4101) (Kit: 799-601-4201)
	☆ Non-polarity	—	

BJH13182

DT series connector for engine			
No. of pins	WIF(water in fuel)sensor(107, 114 engine)		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 <p>BWP05037</p>	 <p>BWP05038</p>	799-601-9020 (kit:799-601-4101) (kit:799-601-4201)
	Part No. :08192-12200 (normal type) 08192-22200 (fine wire type)	Part No. :08192-12100 (normal type) 08192-22100 (fine wire type)	
No. of pins	EGR (by pass) valve stroke sensor (125, 140, 170 engine)		
	Body (plug)	Body (receptacle)	T-adapter Part No.
4	 <p>BWP05041</p>	 <p>BWP05042</p>	799-601-9040 (kit:799-601-4101) (kit:799-601-4201)
	Part No. :08192-14200 (normal type) 08192-24200 (fine wire type)	Part No. :08192-14100 (normal type) 08192-24100 (fine wire type)	

B3W14066

T- branch box and T- branch adapter table

(Rev. 2008.02)

- ★ The vertical column indicates a part number of T-branch box or T-branch adapter while the horizontal column indicates a part number of harness checker assembly.

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit												Out of kit	
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300		799-601-4101
799-601-2600	T-box (for ECONO)	21		●		●		●	●		●						
799-601-3100	T-box (for MS)	37															●
799-601-3200	T-box (for MS)	37															●
799-601-3380	Plate for MS (14-pin)																●
799-601-3410	Adapter for BENDIX (MS)	24	MS-24P														●
799-601-3420	Adapter for BENDIX (MS)	24	MS-24P														●
799-601-3430	Adapter for BENDIX (MS)	17	MS-17P														●
799-601-3440	Adapter for BENDIX (MS)	17	MS-17P														●
799-601-3450	Adapter for BENDIX (MS)	5	MS-5P														●
799-601-3460	Adapter for BENDIX (MS)	10	MS-10P														●
799-601-3510	Adapter for BENDIX (MS)	5	MS-5P														●
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P														●
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P														●
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P														●
799-601-3470	Case																●
799-601-2710	Adapter for MIC	5	MIC-5P	●	●				●								
799-601-2720	Adapter for MIC	13	MIC-13P	●	●				●								
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●		●	●		●						
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●		●	●		●						
799-601-2950	Adapter for MIC	9	MIC-9P				●	●	●		●						
799-601-2750	Adapter for ECONO	2	ECONO2P	●	●												
799-601-2760	Adapter for ECONO	3	ECONO3P	●	●												
799-601-2770	Adapter for ECONO	4	ECONO4P	●	●												
799-601-2780	Adapter for ECONO	8	ECONO8P	●	●												
799-601-2790	Adapter for ECONO	12	ECONO12P	●	●												
799-601-2810	Adapter for DLI	8	DLI-8P	●	●												
799-601-2820	Adapter for DLI	12	DLI-12P	●	●												
799-601-2830	Adapter for DLI	16	DLI-16P	●	●												
799-601-2840	Extension cable (ECONO type)	12	ECONO12P	●	●				●								
799-601-2850	Case			●													
799-601-4350	T-box (for DRC 60, ECONO)	60														●	
799-601-4360	Case															●	
799-601-7010	Adapter for X (T-adapter)	1							●		●						
799-601-7020	Adapter for X	2	X2P				●	●	●		●						
799-601-7030	Adapter for X	3	X3P				●	●	●		●						
799-601-7040	Adapter for X	4	X4P				●	●	●		●						
799-601-7050	Adapter for SWP	6	SW6P				●	●	●								
799-601-7060	Adapter for SWP	8	SW8P				●	●	●								
799-601-7310	Adapter for SWP	12	SW12P														●
799-601-7070	Adapter for SWP	14	SW14P						●		●						
799-601-7320	Adapter for SWP	16	SW16P														●
799-601-7080	Adapter for M (T-adapter)	1							●		●						
799-601-7090	Adapter for M	2	M2P				●	●	●		●						
799-601-7110	Adapter for M	3	M3P				●	●	●		●						

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit														Out of kit
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	799-601-4101	799-601-4201	
799-601-7120	Adapter for M	4	M4P				●	●	●	●								
799-601-7130	Adapter for M	6	M6P				●	●	●	●								
799-601-7340	Adapter for M	8	M8P														●	
799-601-7140	Adapter for S	8	S8P				●	●	●	●								
799-601-7150	Adapter for S (White)	10	S10P				●	●	●	●								
799-601-7160	Adapter for S (Blue)	12	S12P				●	●	●									
799-601-7170	Adapter for S (Blue)	16	S16P				●	●	●	●								
799-601-7330	Adapter for S (White)	16	S16PW							●								
799-601-7350	Adapter for S (White)	12	S12PW														●	
799-601-7180	Adapter for AMP040	8	A8P						●									
799-601-7190	Adapter for AMP040	12	A12P						●	●								
799-601-7210	Adapter for AMP040	16	A16P				●	●	●	●								
799-601-7220	Adapter for AMP040	20	A20P				●	●	●	●								
799-601-7230	Short connector for X	2	—				●	●	●	●								
799-601-7240	Case						●	●										
799-601-7270	Case								●									
799-601-7510	Adapter for 070	10	07-10							●								
799-601-7520	Adapter for 070	12	07-12							●								
799-601-7530	Adapter for 070	14	07-14							●								
799-601-7540	Adapter for 070	18	07-18							●								
799-601-7550	Adapter for 070	20	07-20							●								
799-601-7360	Adapter for relay	5	REL-5P														●	
799-601-7370	Adapter for relay	6	REL-6P														●	
799-601-7380	Adapter for JFC	2	—														●	
799-601-9010	Adapter for DTM	2	DTM2									●		●				
799-601-9020	Adapter for DT	2	DT2									●		●		●	●	
799-601-9030	Adapter for DT	3	DT3									●		●				
799-601-9040	Adapter for DT	4	DT4									●		●		●	●	
799-601-9050	Adapter for DT	6	DT6									●		●				
799-601-9060	Adapter for DT (Gray)	8	DT8GR									●		●				
799-601-9070	Adapter for DT (Black)	8	DT8B									●		●				
799-601-9080	Adapter for DT (Green)	8	DT8G									●		●				
799-601-9090	Adapter for DT (Brown)	8	DT8BR									●		●				
799-601-9110	Adapter for DT (Gray)	12	DT12GR									●		●				
799-601-9120	Adapter for DT (Black)	12	DT12B									●		●				
799-601-9130	Adapter for DT (Green)	12	DT12G									●		●				
799-601-9140	Adapter for DT (Brown)	12	DT12BR									●		●				
799-601-9210	Adapter for HD30-18	8	D18-8									●	●					
799-601-9220	Adapter for HD30-18	14	D18-14									●	●					
799-601-9230	Adapter for HD30-18	20	D18-20									●	●					
799-601-9240	Adapter for HD30-18	21	D18-21									●	●					
799-601-9250	Adapter for HD30-24	9	D24-9									●	●					
799-601-9260	Adapter for HD30-24	16	D24-16									●	●					
799-601-9270	Adapter for HD30-24	21	D24-21									●	●					
799-601-9280	Adapter for HD30-24	23	D24-23									●	●					
799-601-9290	Adapter for HD30-24	31	D24-31									●	●					
799-601-9310	Plate for HD30 (24-pin)											●	●		●			
799-601-9320	T-box (for ECONO)	24										●	●		●			

Part No.	Part name	Number of pins	Identification symbol	T-adapter kit												Out of kit		
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300		799-601-4101	799-601-4201
799-601-9330	Case												●					
799-601-9340	Case												●					
799-601-9350	Adapter for DRC	40	DRC-40												●			
799-601-9360	Adapter for DRC	24	DRC-24												●			
799-601-9410*	Socket for engine (CRI-T2)	2	G															●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3) PFUEL Oil pressure sensor	3	A3													●	●	
799-601-9430*	Socket for engine (CRI-T2) Socket for engine (CRI-T3) PCV	2	P													●	●	
799-601-9440*	Socket for engine (CRI-T2)	3	1,2,3															●
795-799-5520*	Socket for engine (HPI-T2)	2	S															●
795-799-5530*	Socket for engine (HPI-T2) Socket for engine (CRI-T3) Temperature sensor	2	C													●	●	
795-799-5540*	Socket for engine (HPI-T2) Socket for engine (CRI-T3) TIM	2	A													●	●	
795-799-5460	Cable for engine (HPI-T2)	3	—															●
795-799-5470	Cable for engine (HPI-T2)	3	—															●
795-799-5480	Cable for engine (HPI-T2)	3	—															●
799-601-4110	Adapter for engine (140-T3) PIM	4	ITT3N													●	●	
799-601-4130	Adapter for engine (CRI-T3) NE, CAM	3	FCIN													●	●	
799-601-4140	Adapter for engine (CRI-T3) Atomosphere pressure	3	FCIG													●	●	
799-601-4150	Adapter for engine (CRI-T3) POIL	3	FCIB													●	●	
799-601-4160	Adapter for engine (CRI-T3) Oil pressure switch	2	4160													●	●	
799-601-4180	Adapter for engine (CRI-T3) PEVA	3	4180													●	●	
799-601-4190*	Socket for engine (CRI-T3) Commonrail pressure	3	1,2,3L													●	●	
799-601-4230*	Socket for engine (CRI-T3) Air intake pressure/temperature	4	1,2,3,4C													●	●	
799-601-4240*	Socket for engine (CRI-T3) PAMB	3	1,2,3A													●	●	
799-601-4250*	Socket for engine (CRI-T3) PIM	3	1,2,3B													●	●	
799-601-4330*	Socket for engine (CRI-T3) G	3	1,2,3,G													●	●	
799-601-4340*	Socket for engine (CRI-T3) Pump actuator	2	2,PA													●	●	
799-601-4380*	Socket for engine (CRI-T3)(95) Air intake pressure/temperature	4	1,2,3,4T															●
799-601-4260	Adapter for controller (ENG)	4	DTP4													●	●	
799-601-4211	Adapter for controller (ENG)	50	DRC50													●		
799-601-4220	Adapter for controller (ENG)	60	DRC60													●		
799-601-4390*	Socket for controller (95 ENG)	60	—															●
799-601-4280	Box for controller (PUMP)	121	—															●
799-601-9720	Adapter for controller (HST)	16	HST16A															●
799-601-9710	Adapter for controller (HST)	16	HST16B															●
799-601-9730	Adapter for controller (HST)	26	HST26A															●
799-601-9890	Multi-adapter for DT2 – 4 and DTM2	2, 3, 4	—															●

“**” Shows not T-adapter but socket.

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04382-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

40 Troubleshooting

200 Troubleshooting of electrical system (E-mode)

Before carrying out troubleshooting of electrical system	2
E-1 Engine does not start	4
E-2 Engine does not stop	12
E-3 When starting switch is turned ON, any item does not operate	14
E-4 When starting switch is turned ON, some items do not operate	16
E-5 Alarm buzzer is abnormal	17
E-6 Engine oil pressure caution is turned ON	19
E-7 Charge level caution is turned ON	20
E-8 Preheating system does not operate or preheater does not become hot	22
E-9 Coolant temperature gauge is abnormal	24
E-10 Fuel level gauge is abnormal	28
E-11 Service meter does not operate while engine is running	32
E-12 2nd travel speed is not selected	34
E-13 Working lamp does not light up	38
E-14 When work equipment lock (PPC basic pressure lock) lever is set in LOCK, work equipment still moves	40
E-15 Windshield wiper does not operate	42
E-16 Windshield washer does not operate	44
E-17 Defective air conditioner	46

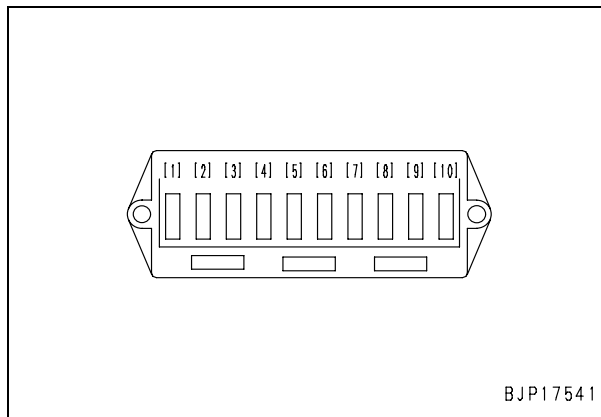
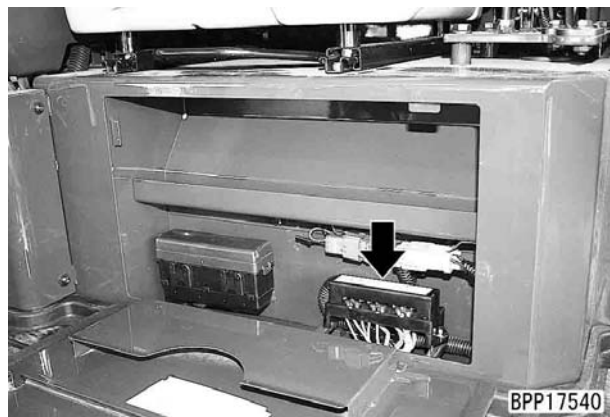
Before carrying out troubleshooting of electrical system

Connection table of fuse box and slow blow fuse

- ★ This connection table indicates the devices to which the power of the fuse box and slow blow fuse is supplied. (A switch power supply is a device which supplies powers while the starting switch is in the ON position and unswitched power supply is a device which supplies power while the starting switch is in the OFF and ON positions).
- ★ When carrying out troubleshooting related to the electrical system, you should check the fuses and slow blow fuse to see if the power is supplied normally.

Type of power supply	Fuse No.	Fuse capacity	Destination of power supply
Accessory power supply	1	30 A (CAB) 10 A (CAN)	Working lamp
	2	10 A	Fuel pump
			PPC lock solenoid relay
			Horn switch
	3	10 A	Machine monitor
			Alarm buzzer
			Speedup solenoid relay, PPC lock switch
	4	10 A	Arm crane
			KOMTRAX terminal
	5	20 A (CAB) 10 A (CAN)	Air conditioner
			Heater
			Travel alarm
	6	20 A	Room lamp (CAB)
			Radio (CAB)
			Wiper motor (CAB)
			Washer motor (CAB)
	7	30 A	Engine stop solenoid
Unswitched power supply (Fusible link of 45 A: M4)	8	10 A	Machine monitor
			Arm crane controller
			Radio
Accessory power supply	9	10 A	Arm crane (Load power supply)
—	10	—	(Spare)

- CAB: Cab specification, CAN: Canopy specification



E-1 Engine does not start**1) Engine does not start (Starting motor does not rotate)**

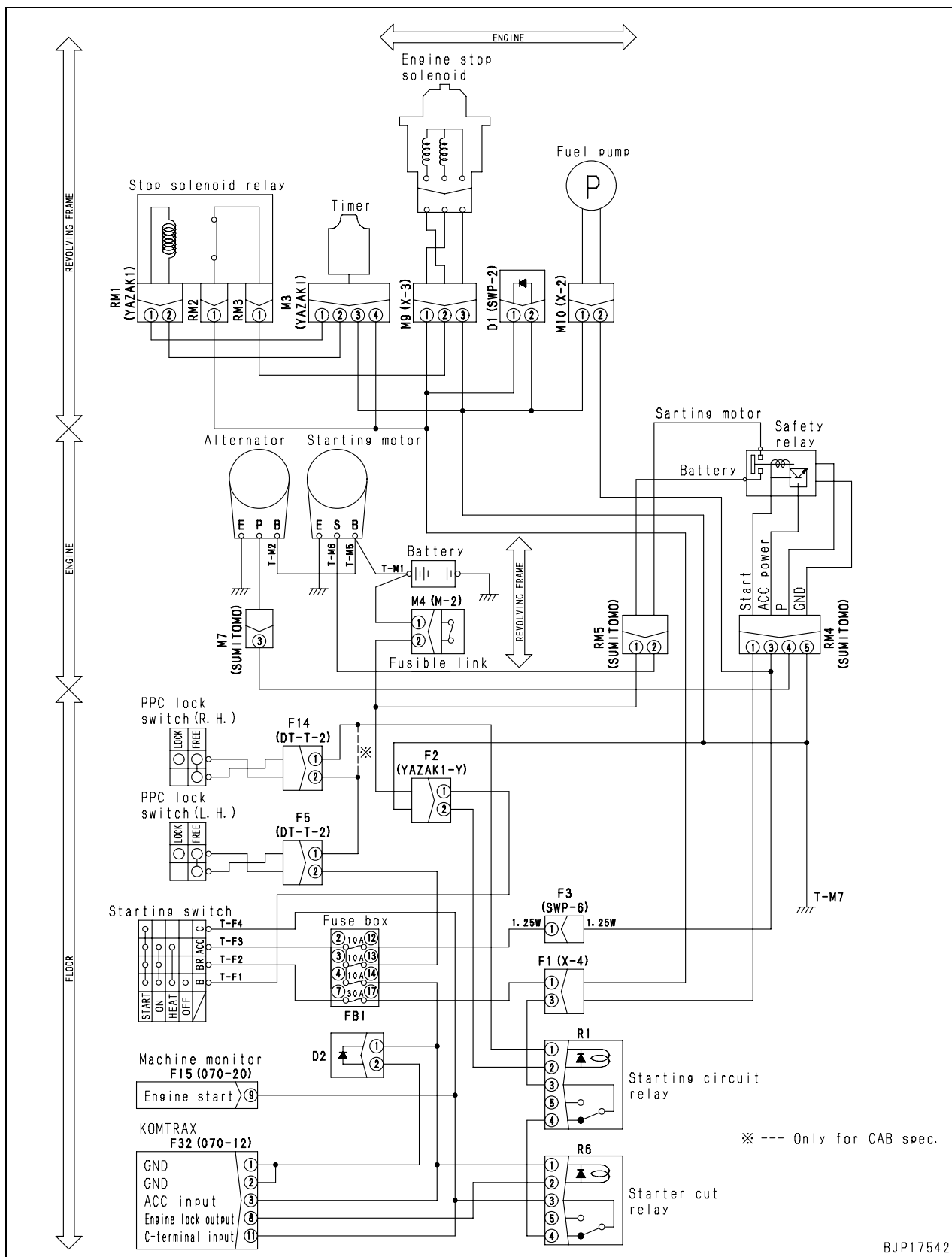
Failure information	<ul style="list-style-type: none"> Engine does not start (Starting motor does not rotate).
Relative information	<ul style="list-style-type: none"> Since the engine starting circuit has a locking function, the engine cannot start if the PPC lock lever (lock lever) is not in the LOCK position. The lock lever is installed to the right and left side of the canopy specification and to the left side of the cab specification.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting		
	1	Insufficient battery capacity	Battery voltage		Electrolyte specific gravity
			Min. 12 V		Min. 1.26
	2	Defective 45-A fusible link or fuse (2) – (12) or (3) – (13)	If the fusible link or fuse is broken, the circuit probably has a grounding fault.		
	3	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.		
			Starting switch	Position	Resistance
			Between (T-F1) terminal B and (T-F4) terminal C	OFF	Min. 1 MΩ
				START	Max. 1 Ω
			Between (T-F1) terminal B and (T-F3) terminal ACC	OFF	Min. 1 MΩ
				ON	Max. 1 Ω
	4	Defective PPC lock switch (left) (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect connector F5. 3) Connect T-adaptor to F5 (male).		
			F5 (male)	Lock lever position	Resistance
			Between (1) and (2)	FREE	Max. 1 Ω
				LOCK	Min. 1 MΩ
	5	Defective PPC lock switch (right) (Internal defective contact) ★ Only canopy specification	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adaptor to F14 (male).		
			F14 (male)	Lock lever position	Resistance
			Between (1) and (2)	FREE	Max. 1 Ω
				LOCK	Min. 1 MΩ
	6	Defective starting motor relay (Internal disconnection, defective contact, or fixing)	1) Turn starting switch OFF. 2) Disconnect relay R1. 3) Connect T-adaptor to R1 (male).		
			R1 (male)	Resistance	
			Between (1) and (2)		86 – 106 Ω
			Between (3) and (4)		Max. 1 Ω
			Between (3) and (5)		Min. 1 MΩ
			1) Turn starting switch OFF. 2) Insert T-adaptor in relay R1. 3) Turn starting switch ON.		
			R1	Voltage	
			Between (4) and ground (Set PPC lock lever in LOCK and starting switch in START)		10 – 15 V

Possible causes and standard value in normal state	Causes		Standard value in normalcy and references for troubleshooting		
	7	Defective starting motor cutout relay (Internal disconnection, defective contact, or fixing)	1) Turn starting switch OFF. 2) Disconnect relay R6. 3) Connect T-adapter to R6 (male).		
			R6 (male)		Resistance
			Between (1) and (2)		86 – 106 Ω
			Between (3) and (4)		Max. 1 Ω
			Between (3) and (5)		Min. 1 MΩ
			1) Turn starting switch OFF. 2) Insert T-adapter in relay R1. 3) Turn starting switch ON.		
			R6		Voltage
			Between (4) and ground (Set PPC lock lever in LOCK and starting switch in START)		10 – 15 V
	8	Defective starting motor	1) Turn starting switch from OFF to START for troubleshooting. (If power supply and starting input/output are normal and starting motor does not rotate, starting motor is defective.)		
			Starting motor		Starting switch Voltage
			Power supply: Between terminal B and ground		ON 10 – 15 V
			Starting input: Between terminal S and ground		START 10 – 15 V
	9	Defective safety relay (Internal defective contact or disconnection)	1) Turn starting switch from OFF to START for troubleshooting.		
			RM5		Voltage
			Between (2) and ground		10 – 15 V
	10	Defective alternator (including regulator) (Internal short circuit)	1) Turn starting switch from OFF to ON or START for troubleshooting.		
			Alternator		Voltage
			Between terminal P and ground		Max. 1 V
	11	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Wiring harness between battery (+) and T-F1 or RM5 (female) (1)		Resistance Max. 1 Ω
			Wiring harness between T-F3 and fuse (2) or between (12) and F3 (1) and RM4 (3)		Resistance Max. 1 Ω
			Wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) ★ Check F14 for only canopy specification.		Resistance Max. 1 Ω
			Wiring harness between T-F4 and R6 (female) (3)		Resistance Max. 1 Ω
			Wiring harness between R1 (female) (3), F1 (3), and RM4 (female) (1)		Resistance Max. 1 Ω
			Wiring harness between RM4 (female) (4) and M7 (female) (3)		Resistance Max. 1 Ω
			Wiring harness between RM5 (female) (2) and starting motor terminal S		Resistance Max. 1 Ω
			Wiring harness between R1 (female) (2), F2 (2), and ground		Resistance Max. 1 Ω
			Wiring harness between RM4 (female) (5) and ground		Resistance Max. 1 Ω
			Wiring harness between R6 (female) (4) and R1 (female) (4)		Resistance Max. 1 Ω

Possible causes and standard value in normal state	Causes		Standard value in normalcy and references for troubleshooting		
	11	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	Wiring harness between R6 (female) (1) and F32 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between R6 (female) (2) and F32 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between T-F4 and F32 (female) (11)	Resistance	Max. 1 Ω
	12	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector or terminal. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between M4 (female) (2), F2 (1), T-F1, or RM5 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (12), F3 (1), RM4 (3), or M10 (female) (2) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between fuse (13) and F5 (2) or between (1) and F14 (2) or between (1) and R1 (female) (1) and ground ★ Test F14 for only canopy specification.	Resistance	Min. 1 M Ω
			Between wiring harness between T-F4 and R6 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R1 (female) (3), F1 (3) and RM4 (female) (1) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between RM4 (female) (4) and M7 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between RM5 (female) (2) and starting motor terminal S and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R6 (female) (4) and R1 (female) (4) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R6 (female) (1) and F32 (female) (3) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between R6 (female) (2) and F32 (female) (8) and ground	Resistance	Min. 1 M Ω
			Between wiring harness between T-F4 and F32 (female) (11) and ground	Resistance	Min. 1 M Ω

Related circuit diagram



2) Engine does not start (Fault in engine stop solenoid)

Failure information	<ul style="list-style-type: none"> Engine does not start (Fault in engine stop solenoid).
Relative information	<ul style="list-style-type: none"> The starting motor rotates but the engine does not start.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Defective fuse (7) – (17)	If the fuse is broken, the circuit probably has a grounding fault.			
	2	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.			
			Starting switch		Position	Resistance
			Between (T-F1) terminal B and (T-F2) terminal BR		OFF	Min. 1 MΩ
					ON	Max. 1 Ω
	3	Defective engine stop solenoid (Internal disconnection or short circuit)	1) Turn starting switch OFF. 2) Disconnect connector M9. 3) Connect T-adaptor to M9 (male).			
			M9 (male)		Resistance	
			Between (1) and (3)		22 – 28 Ω	
			Between (2) and (3)		0.63 – 0.77 Ω	
			Between (1), (2), and body		Min. 1 MΩ	
	4	Defective timer (Internal disconnection or short circuit)	1) Turn starting switch from OFF to ON for troubleshooting.			
			M3	Measurement condition	Voltage	
			Between (1) and (2)	For 1 second after starting switch is turned ON	10 – 15 V	
				After 1 second	Max. 1 V	
	5	Defective engine stop solenoid relay (Internal disconnection or short circuit)	1) Turn starting switch OFF. 2) Disconnect connector RM1.			
			RM1 (male)		Resistance	
			Between (1) and (2)		33 – 41 Ω	
			1) Turn starting switch from OFF to ON for troubleshooting.			
			RM3	Measurement condition	Voltage	
			Between (1) and ground	For 1 second after starting switch is turned ON	10 – 15 V	
				After 1 second	Max. 1 V	
	6	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.			
			Wiring harness between T-F2 and fuse (7), between fuse (17), F1 (1) and M9 (female) (1) or M3 (female) (4) or RM2 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between M9 (female) (2) and RM3 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between M3 (female) (1) and RM1 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between M3 (female) (2) and RM1 (female) (2)		Resistance	Max. 1 Ω
Wiring harness between M9 (female) (3) or M3 (female) (3) and ground			Resistance	Max. 1 Ω		

Possible causes and standard value in normal state	Causes		Standard value in normalcy and references for troubleshooting		
	7	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Between wiring harness between fuse (17), F1 (1) and M9 (female) (1) or M3 (female) (4) or RM2 (female) (1) and ground	Resistance	Min. 1 MΩ
			Between wiring harness between M9 (female) (2) and RM3 (female) (1) and ground	Resistance	Min. 1 MΩ
			Between wiring harness between M3 (female) (1) and RM1 (female) (1) and ground	Resistance	Min. 1 MΩ
			Between wiring harness between M3 (female) (2) and RM1 (female) (2) and ground	Resistance	Min. 1 MΩ

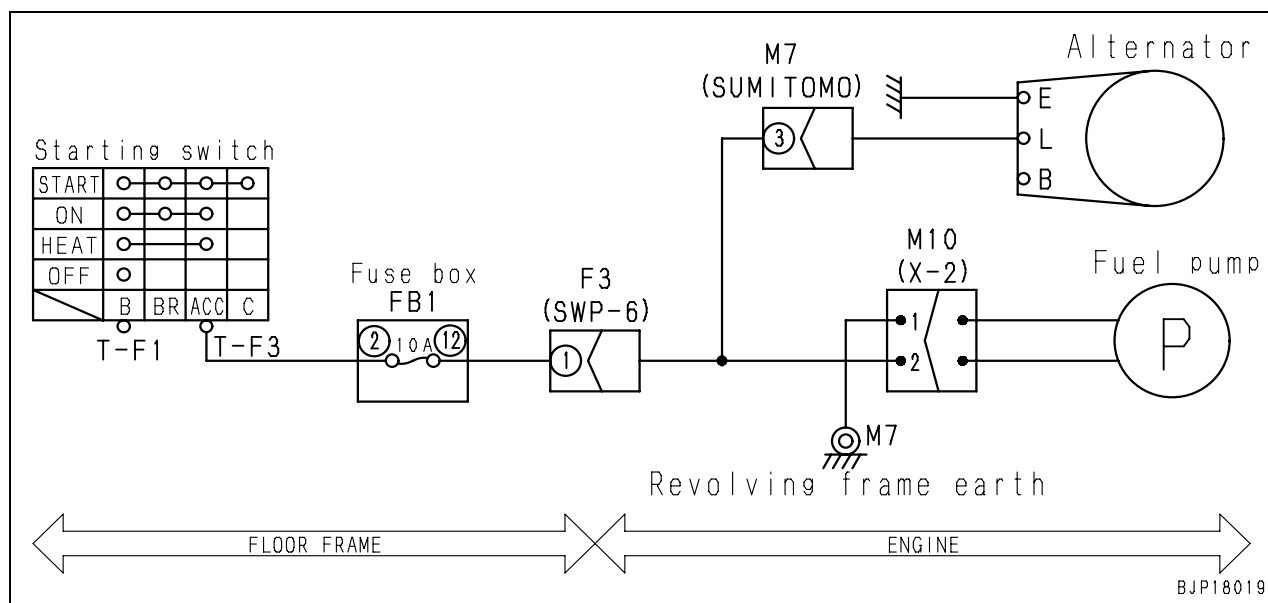
★ For the related circuit diagram, see 1).

3) Engine does not start (Fuel pump system)

Failure information	• Engine does not start (Fuel pump system).
Relative information	• Carry out following troubleshooting when engine stop solenoid system is normal.

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting			
	1	Defective fuse (2) – (12)	If fuse is broken, circuit probably has ground fault.			
	2	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect cable from negative (–) terminal of battery.			
			Starting switch	Position	Resistance	
			Between (T-F1) terminal B – (T-F3) terminal ACC	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	3	Defective fuel pump	1) Turn starting switch OFF. 2) Connect T-adapter to connector M10. 3) Turn starting switch from OFF to ON and carry out troubleshooting.			
			Between M10 (2) – ground		Voltage	10 – 12 V
			1) Turn starting switch OFF. 2) Disconnect connector M10. 3) Connect T-adapter to connector M10 (female).			
			Between M10 (female) (1) – ground		Resistance	Max. 1 Ω
			1) Turn starting switch OFF. 2) Disconnect connectors M10 and M7. 3) Connect T-adapter to connector M10 (female).			
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M10 and M7. 3) Connect T-adapter to connector M10 (female).			
			Wiring harness between fuse (12) – M10 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between M10 (female) (2) – M7 (female) (2)		Resistance	Max. 1 Ω
			Between M10 (female) (1) – ground		Resistance	Max. 1 Ω
	5	Ground fault in wiring harness (Contact with GND or GND circuit)	1) Turn starting switch OFF. 2) Disconnect connectors M10 and M7. 3) Connect T-adapter to connector M10 (female).			
Between wiring harness fuse (12) – M10 (female) (2) and ground			Resistance	Min. 1 MΩ		
Between wiring harness M10 (female) (2) – M7 (female) (2) and ground			Resistance	Min. 1 MΩ		

Related circuit diagram



E-2 Engine does not stop

Failure information	<ul style="list-style-type: none"> Engine does not stop.
Relative information	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective engine stop solenoid (Internal defect)	1) Turn starting switch OFF. 2) Disconnect connector M9. 3) Connect T-adapter to M9 (male).			
			M9 (male)		Resistance	
			Between (1) and (3)		22 – 28 Ω	
			Between (2) and (3)		0.63 – 0.77 Ω	
	2	Defective starting switch (Internal short circuit)	1) Turn starting switch from START to OFF for troubleshooting.			
			Starting switch	Position	Voltage	
			Between (T-F2) terminal BR and ground	OFF	Max. 1 V	
	3	Short circuit with power source in wiring harness (Contact with 12 V circuit)	1) Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between wiring harness between T-F2 and M9 (female) (1) and ground		Voltage	Max. 1 V

The diagram illustrates the electrical system for the engine and floor sections. It includes components such as the engine stop solenoid, fuel pump, stop solenoid relay, timer, alternator, starting motor, battery, safety relay, PPC lock switches, starting switch, machine monitor, KOMTRAX, fuse box, and various relays (F1, F2, F3, F4, F5, F14, R1, R6). The diagram is divided into three horizontal sections: ENGINE (top), REVOLVING FRAME (middle), and FLOOR (bottom).

ENGINE SECTION:

- Engine stop solenoid
- Fuel pump
- Stop solenoid relay
- Timer
- Alternator
- Starting motor
- Battery
- Safety relay
- Start ACC power
- GND
- RM1 (YAZAKI)
- RM2
- RM3
- M3 (YAZAKI)
- M9 (X-3)
- D1 (SWP-2)
- M10 (X-2)
- M7 (SUMITOMO)
- M4 (M-2)
- Fusible link
- RM5 (SUMITOMO)
- RM4 (SUMITOMO)

REVOLVING FRAME SECTION:

- PPC lock switch (R. H.)
- PPC lock switch (L. H.)
- Starting switch
- Machine monitor F15 (070-20)
- KOMTRAX F32 (070-12)
- Fuse box
- F1 (X-4)
- R1
- R6

FLOOR SECTION:

- Engine start
- ACC input
- Engine lock output
- C-terminal input

Legend:

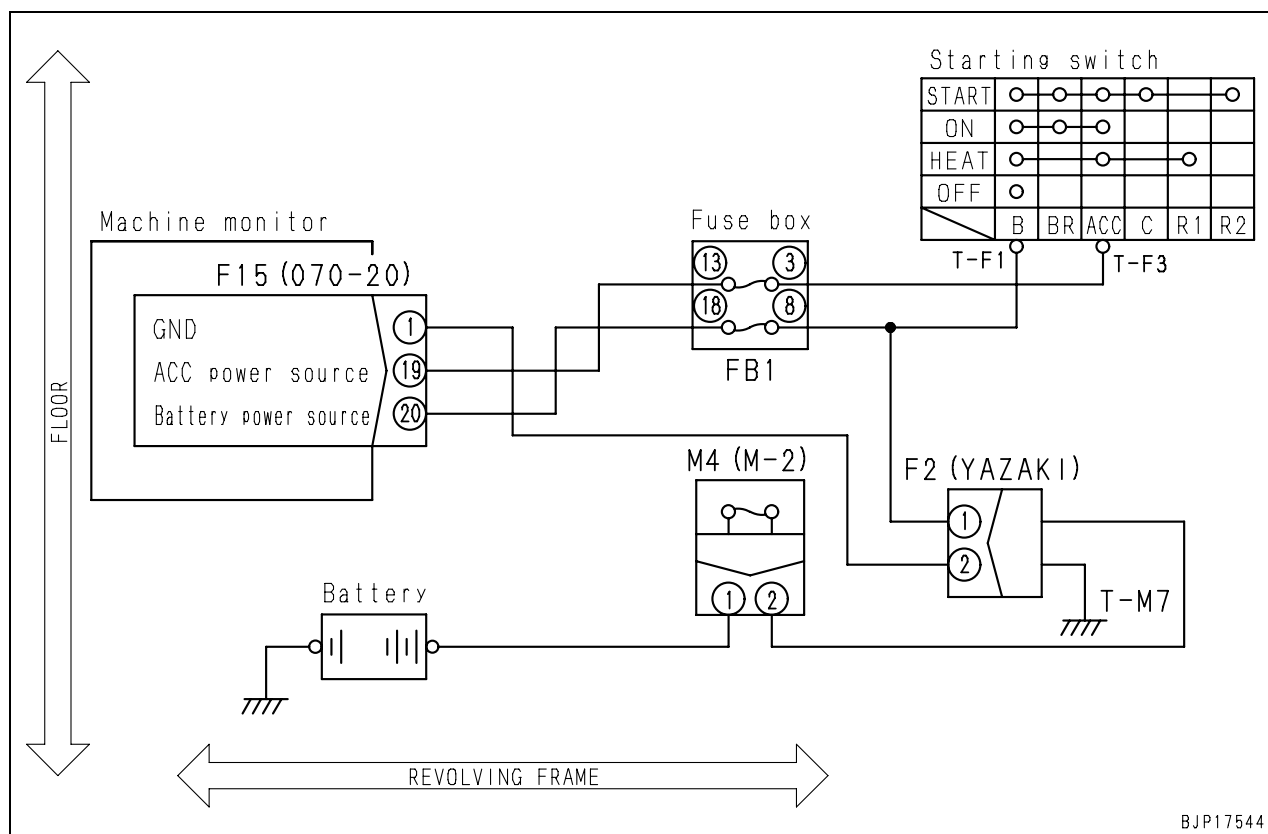
- ※ --- Only for CAB spec.

E-3 When starting switch is turned ON, any item does not operate

Failure information	<ul style="list-style-type: none"> When the starting switch is turned from OFF to ON, the following faults occur in the self-check of the monitor panel. <ol style="list-style-type: none"> 1) The warning lamps and indicators do not light up (for 3 seconds). 2) The buzzer does not sound (for 1 second). The fuel level gauge and coolant temperature gauge do not operate even a while after the starting switch is turned ON.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that fuses No. (3) – (13) and No. (8) – (18) and fusible link are not broken.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)		1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Turn starting switch ON.		
			Between F15 (female) (20) and ground	Voltage	10 – 15 V
			Between F15 (female) (19) and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Remove fuses No. (3) – (13) and No. (8) – (18). 3) Turn starting switch ON.		
			Between FB1 (8) and ground	Voltage	10 – 15 V
			Between FB1 (3) and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Remove starting switch. 3) Turn starting switch ON.		
			Between T-F1 and ground	Voltage	10 – 15 V
			Between T-F3 and ground	Voltage	10 – 15 V
			1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to female side of F15.		
			Wiring harness between F15 (female) (1) and ground	Resistance	Max. 1 Ω
	2	Defective monitor panel	If the floor wiring harness is normal, the monitor panel is defective.		

Related circuit diagram



E-4 When starting switch is turned ON, some items do not operate

Failure information	<ul style="list-style-type: none"> When the starting switch is turned from OFF to ON, the following faults occur in the self-check of the monitor panel. <ol style="list-style-type: none"> Some warning lamps and indicators do not light up (for 3 seconds). The buzzer does not sound (for 1 second). The fuel level gauge and coolant temperature gauge do not operate even a while after the starting switch is turned ON.
Relative information	<ul style="list-style-type: none"> Distinguish this fault from “E-3 When starting switch is turned ON, any item does not operate”.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Defective monitor panel	

See Structure, function and maintenance standard, “Monitor system”.

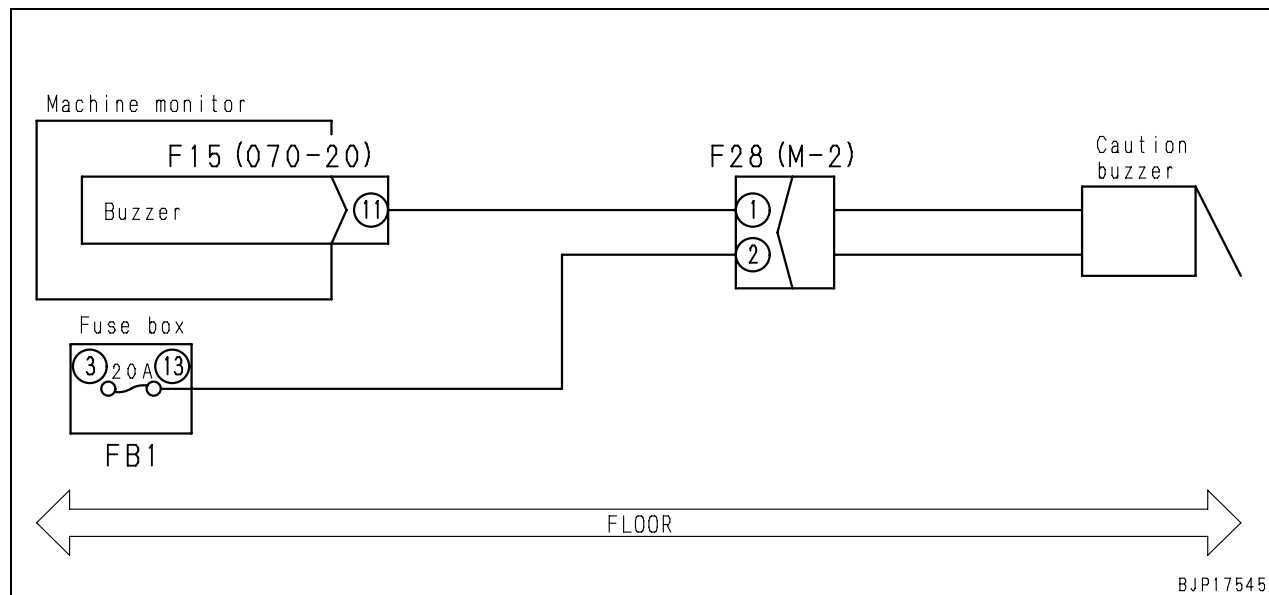
E-5 Alarm buzzer is abnormal

1) Alarm buzzer does not sound

Failure information	<ul style="list-style-type: none"> When the starting switch is turned from OFF to ON, the self-check buzzer does not sound (for 1 second). When the starting switch is turned ON and the 2nd travel speed selection switch and light switch are pressed, the selection sound (a short sound) is not heard.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that fuse No. (3) – (13) is not broken. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective monitor panel	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Turn starting switch ON.		
			Connect F15 (female) (11) to ground.	Buzzer	Sounds only when connected.
	2	Defective alarm buzzer	1) Turn starting switch OFF. 2) Insert T-adapter in connector F28. 3) Turn starting switch ON.		
			Connect T-adapter box No. 1 to ground.	Buzzer	Sounds only when connected.
			Between F28 (2) and ground	Voltage	10 – 15 V
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors F15 and F28. 3) Connect T-adapter to F15 (female) and F28 (female).		
			Wiring harness between F15 (female) (11) and F28 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between fuse (13) and F28 (female) (2)	Resistance	Max. 1 Ω

Related circuit diagram



2) Alarm buzzer does not stop sounding

Failure information	<ul style="list-style-type: none"> Alarm buzzer does not stop sounding.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that fuse No. (3) – (13) is not broken. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective monitor panel	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Turn starting switch ON.		
			Disconnect connector F15, and turn starting switch ON.	Buzzer	Stops sounding.
	2	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors F15 and F28. 3) Connect T-adaptor to F15 (female) and F28 (female).		
			Between wiring harness between F15 (female) (11) and F28 (female) (1) and ground	Resistance	Min. 1 MΩ

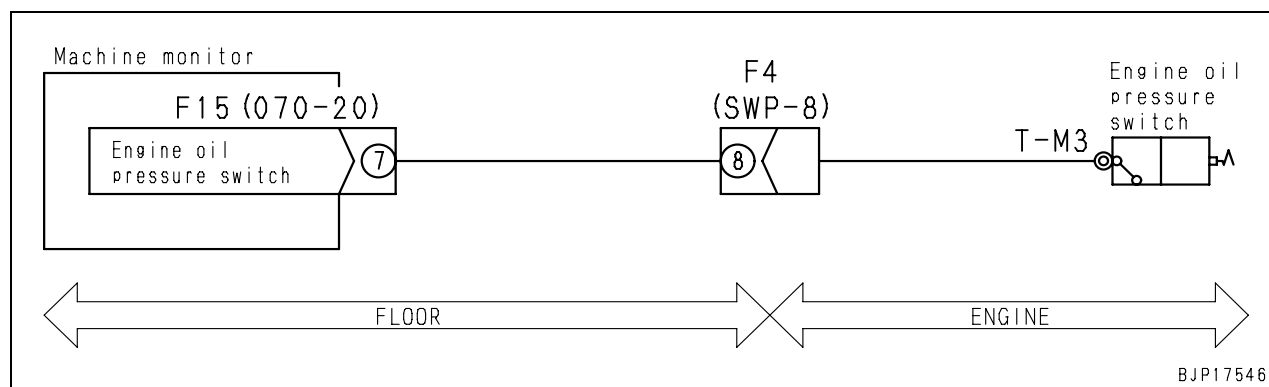
★ For the related circuit diagram, see 1).

E-6 Engine oil pressure caution is turned ON

Failure information	<ul style="list-style-type: none"> The monitor panel performs the following operations to notify abnormal engine oil pressure while the engine is running. <ol style="list-style-type: none"> The engine oil pressure caution lamp flashes. The buzzer sounds.
Relative information	<ul style="list-style-type: none"> Check that the engine oil pressure is normal. When the starting switch is turned from OFF to ON, the monitor panel performs the following operations. This does not indicate a fault. <ol style="list-style-type: none"> The engine oil pressure caution lamp and charge level caution lamp light up. The buzzer does not sound.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	<ol style="list-style-type: none"> Turn starting switch OFF. Disconnect T-M3 and connector F15. Connect T-adaptor to F15 (female). 		
			Between wiring harness between F15 (female) (7) and T-M3 and ground	Resistance	Min. 1 MΩ
	2	Defective monitor panel	<ol style="list-style-type: none"> Turn starting switch OFF. Disconnect T-M3. Start engine. 		
			While T-M3 is disconnected	Oil pressure caution	Stopped
	3	Defective engine oil pressure switch	If the monitor panel and wiring harnesses are normal, the engine oil pressure switch is defective.		

Related circuit diagram

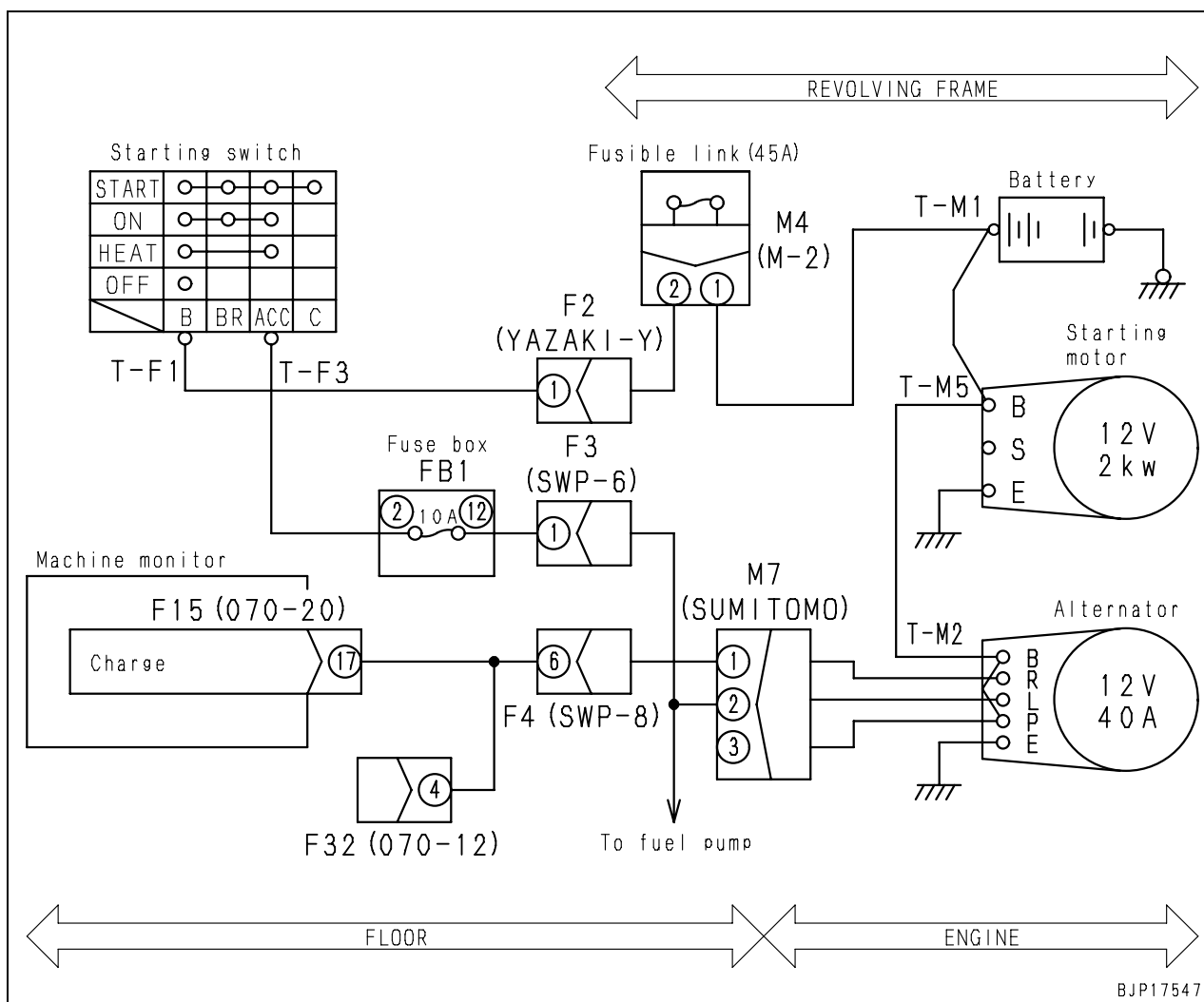


E-7 Charge level caution is turned ON

Failure information	<ul style="list-style-type: none"> The monitor panel performs the following operations to notify abnormal charge level while the engine is running. <ol style="list-style-type: none"> The charge level caution lamp flashes. The buzzer sounds.
Relative information	<ul style="list-style-type: none"> Check that the fan belt tension is normal. When the starting switch is turned from OFF to ON, the monitor panel performs the following operations. This does not indicate a fault. <ol style="list-style-type: none"> The engine oil pressure caution lamp and charge level caution lamp light up. The buzzer does not sound.

	Causes		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective alternator (Internal disconnection)	1) Prepare with starting switch OFF. 2) Start engine and carry out troubleshooting.		
			Between M7 (1) and ground (just after starting engine)	Voltage	13.5 – 14.5 V
	2	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M7 and F15. 3) Connect T-adapter to female side of F15.		
			Wiring harness between battery (+) terminal and alternator terminal B	Resistance	Max. 1 Ω
			Wiring harness between M7 (female) (1), F4 (6) and F15 (female) (17)	Resistance	Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors M7 and F15. 3) Connect T-adapter to female side of F15.		
			Between wiring harness between F15 (female) (17), F4 (6) and M7 (female) (1) and ground	Resistance	Min. 1 M Ω
	4	Defective monitor panel	1) Turn starting switch OFF. 2) Insert T-adapter in F15. 3) Start engine.		
			Between F15 (17) and ground (just after starting engine)	Voltage	13.5 – 14.5 V

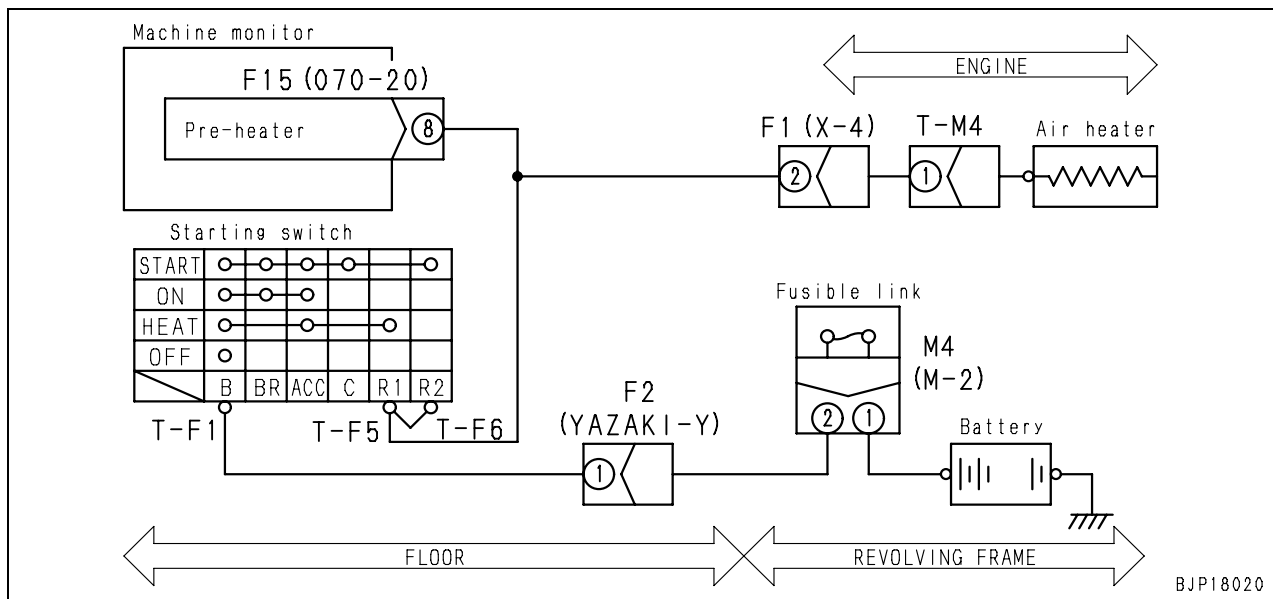
Related circuit diagram



E-8 Preheating system does not operate or preheater does not become hot

Failure information	<ul style="list-style-type: none"> When the starting switch is set to HEAT, the following preheating system of the monitor panel does not operate. 1) The preheating indicator flashes (for about 18 seconds). 2) The buzzer sounds at start and end of preheating.
Relative information	<ul style="list-style-type: none"> Check that the fusible link is not broken. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective fusible link	If the fusible link is burned, the circuit probably has a grounding fault.		
	2	Defective air heater (Internal disconnection)	1) Prepare with starting switch OFF. 2) Turn starting switch ON and carry out troubleshooting.		
	3	Defective starting switch (Internal defective contact)	Between T-M4 (female) (1) and ground	Voltage	10 – 15 V
			Between T-F1 and T-F5 or T-F6	Resistance	Max. 1 Ω
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connectors and terminals. 3) Connect T-adaptor to female side of F15.		
			Wiring harness between T-M4 (female) (1), F1 (2) and T-F5, T-F6 or F15 (female) (8)	Resistance	Max. 1 Ω
			Wiring harness between T-F1 and F2 (1) and M4 (2) (1) and positive (+) terminal of battery	Resistance	Max. 1 Ω

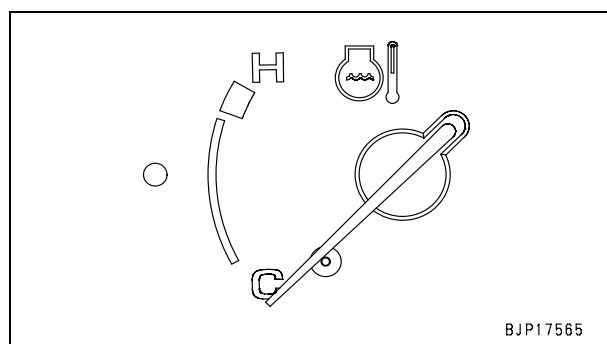
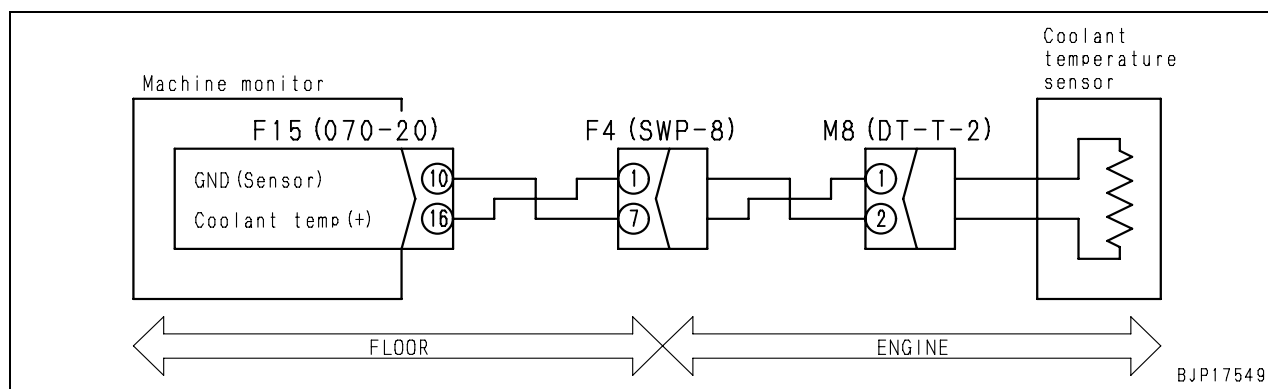
Related circuit diagram

E-9 Coolant temperature gauge is abnormal**1) The pointer of the gauge does not move from C on the panel**

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the pointer of the gauge does not move from C on the panel.
Relative information	<ul style="list-style-type: none"> Check that the coolant temperature is normal. While the starting switch is in OFF, the pointer does not move from C. This is not abnormal. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M8 and F15. 3) Connect T-adapter to M8 (female) and F15 (female).		
			Wiring harness between F15 (female) (10), F4 (7) and M8 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (16), F4 (1) and M8 (female) (2)	Resistance	Max. 1 Ω
	2	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M8. 3) Connect T-adapter to M8 (male).		
			M8 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 k Ω
				30°C	31.59 – 39.07 k Ω
				80°C	6.199 – 6.935 k Ω
				85°C	5.386 – 5.975 k Ω
				90°C	4.695 – 5.166 k Ω
				95°C	4.107 – 4.483 k Ω
				100°C	3.604 – 3.903 k Ω
				105°C	3.157 – 3.426 k Ω
	3	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

Related circuit diagram

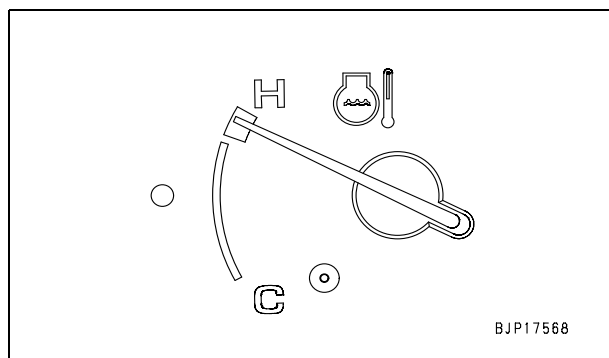


2) The pointer of the gauge does not move from H on the panel

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the pointer of the gauge does not move from H on the panel.
Relative information	<ul style="list-style-type: none"> Check that the coolant temperature is normal. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M8 and F15. 3) Connect T-adapter to M8 (female) and F15 (female).		
			Wiring harness between F15 (female) (10) or M8 (female) (1) and ground	Resistance	Min. 1 MΩ
			Wiring harness between F15 (female) (16) or M8 (female) (2) and ground	Resistance	Min. 1 MΩ
	2	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M8. 3) Connect T-adapter to M8 (male).		
			M8 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 kΩ
				30°C	31.59 – 39.07 kΩ
				80°C	6.199 – 6.935 kΩ
				85°C	5.386 – 5.975 kΩ
				90°C	4.695 – 5.166 kΩ
				95°C	4.107 – 4.483 kΩ
				100°C	3.604 – 3.903 kΩ
				105°C	3.157 – 3.426 kΩ
	3	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram, see 1).



3) Temperature indicated by gauge is very different from actual temperature

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the temperature indicated by the gauge is very different from the actual temperature.
Relative information	<ul style="list-style-type: none"> Check that the coolant temperature is normal. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective coolant temperature sensor	1) Turn starting switch OFF. 2) Disconnect connector M8. 3) Connect T-adapter to M8 (male).		
			M8 (male)	Temperature	Resistance
			Between (1) and (2)	25°C	38.18 – 47.77 kΩ
				30°C	31.59 – 39.07 kΩ
				80°C	6.199 – 6.935 kΩ
				85°C	5.386 – 5.975 kΩ
				90°C	4.695 – 5.166 kΩ
				95°C	4.107 – 4.483 kΩ
				100°C	3.604 – 3.903 kΩ
				105°C	3.157 – 3.426 kΩ
	2	Defective monitor panel	If the wiring harness and coolant temperature sensor are normal, the monitor panel is defective.		

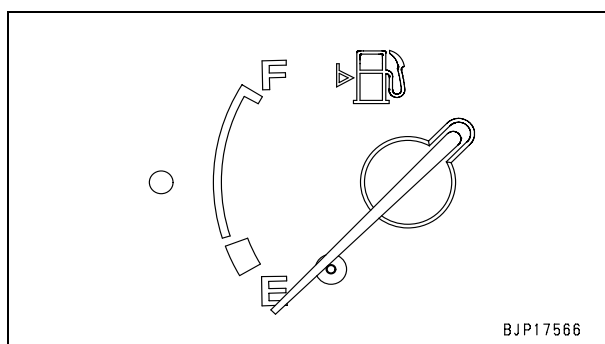
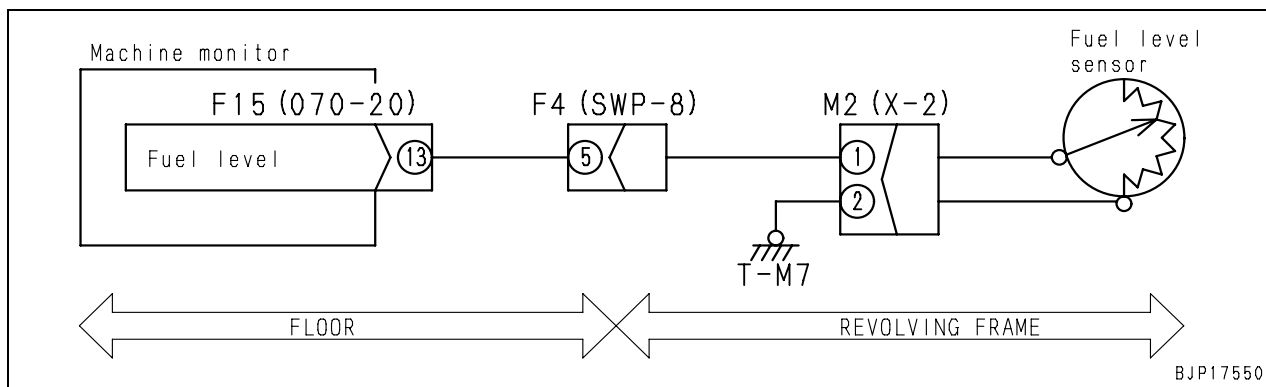
★ For the related circuit diagram, see 1).

E-10 Fuel level gauge is abnormal**1) The pointer of the gauge does not move from E on the panel**

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the pointer of the gauge does not move from E on the panel.
Relative information	<ul style="list-style-type: none"> Check that the fuel level is normal. While the starting switch is in OFF, the pointer does not move from E. This is not abnormal. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors M2 and F15. 3) Connect T-adapter to M2 (female) and F15 (female).		
			Wiring harness between F15 (female) (13) and M2 (female) (1)	Resistance	Max. 1 Ω
			1) Turn starting switch OFF. 2) Disconnect connectors M2. 3) Connect T-adapter to M2 (female).		
			Wiring harness between M2 (female) (2) and ground	Resistance	Max. 1 Ω
	2	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M2. 3) Connect T-adapter to M2 (male).		
			M2 (male)	Position of float	Resistance () is reference value.
			Between (1) and (2)	FULL	$0^{+2}_{-0} \Omega$
				1/2	(50) Ω
				EMPTY	$150 \pm 10 \Omega$
	3	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

Related circuit diagram

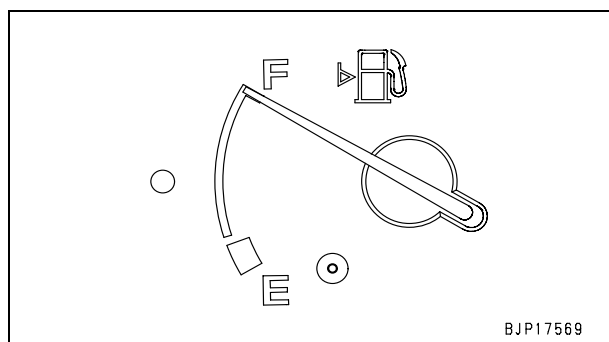


2) The pointer of the gauge does not move from F on the panel

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the pointer of the gauge does not move from F on the panel.
Relative information	<ul style="list-style-type: none"> Check that the fuel level is normal. Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors M2 and F15. 3) Connect T-adapter to M2 (female) and F15 (female).		
			Wiring harness between F15 (female) (13) and M2 (female) (1)	Resistance	Min. 1 MΩ
	2	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M2. 3) Connect T-adapter to M2 (male).		
			M2 (male)	Position of float	Resistance () is reference value.
			Between (1) and (2)	FULL	$0_{-0}^{+2} \Omega$
				1/2	(50) Ω
				EMPTY	$150 \pm 10 \Omega$
	3	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram, see 1).



3) Fuel level indicated by gauge is very different from actual oil level

Failure information	<ul style="list-style-type: none"> When the starting switch is turned ON, the fuel level indicated by the gauge is very different from the actual temperature.
Relative information	<ul style="list-style-type: none"> Check that the fuel level is normal. Refer to troubleshooting E-3, too.

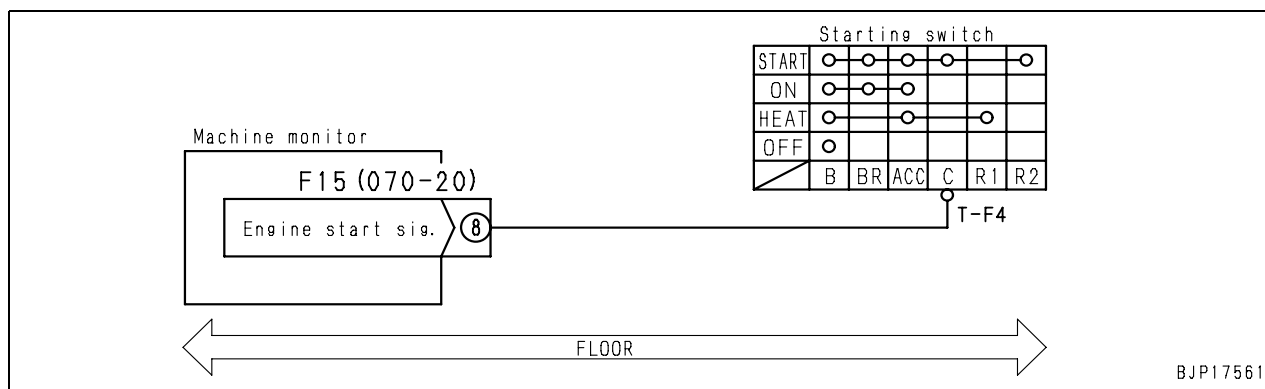
Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective fuel level sensor	1) Turn starting switch OFF. 2) Disconnect connector M2. 3) Connect T-adaptor to M2 (male).		
			M2 (male)	Position of float	Resistance () is reference value.
			Between (1) and (2)	FULL	$0^{+2}_{-0} \Omega$
				1/2	(50) Ω
			EMPTY		$150 \pm 10 \Omega$
	2	Defective monitor panel	If the wiring harness and fuel level sensor are normal, the monitor panel is defective.		

★ For the related circuit diagram, see 1).

E-11 Service meter does not operate while engine is running**1) Engine oil pressure caution is turned ON**

Failure information	1) Service meter (Operating hour integrator) does not operate while engine is running.	Engine oil pressure caution is turned ON.
Relative information	<ul style="list-style-type: none"> While the engine is running, the service meter operates even if the machine does not move at all. While the engine is stopped, the service meter does not operate. Refer to troubleshooting E-3, too. <p>★ Carry out troubleshooting "E-6 Engine oil pressure caution is turned ON" first, then carry out the following troubleshooting.</p>	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to F15 (female). 4) Turn starting switch to START (Do not hold for long time, however).		
			Between T-F4 and ground	Voltage	10 – 15 V
			Between F15 (female) (8) and ground	Voltage	10 – 15 V
	2	Defective monitor panel	If the wiring harness is normal, the monitor panel is defective.		

Related circuit diagram

2) Charge warning is displayed, too

Failure information	2) Service meter (Operating hour integrator) does not operate while engine is running.	Charge warning is displayed, too.
Relative information	<ul style="list-style-type: none"> While the engine is running, the service meter operates even if the machine does not move at all. While the engine is stopped, the service meter does not operate. Refer to troubleshooting E-3, too. <p>★ Carry out the troubleshooting for “E-7 Charge level caution is turned ON” first, then carry out the following troubleshooting.</p>	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector F15. 3) Connect T-adapter to F15 (female). 4) Turn starting switch to START (Do not hold for long time, however).		
			Between T-F4 and ground	Voltage	10 – 15 V
			Between F15 (female) (8) and ground	Voltage	10 – 15 V
	2	Defective monitor panel	If the wiring harness is normal, the monitor panel is defective.		

★ For the related circuit diagram, see 1).

3) Engine oil pressure and charge does not indicate warning

Failure information	3) Service meter (Operating hour integrator) does not operate while engine is running.	Engine oil pressure and charge does not indicate warning.
Relative information	<ul style="list-style-type: none"> While the engine is running, the service meter operates even if the machine does not move at all. While the engine is stopped, the service meter does not operate. Refer to troubleshooting E-3, too. <p>★ If the service meter still does not work after the troubleshooting for E-6 and E-7, the possible cause is as follows.</p>	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective monitor panel	If any abnormality is not detected by 1) and 2), the monitor panel is defective.		

★ For the related circuit diagram, see 1).

E-12 2nd travel speed is not selected

1) Monitor panel does not respond and 2nd travel speed is not selected

Failure information	<ul style="list-style-type: none">When the 2nd travel speed selection switch is pressed while the engine is running, the monitor panel does not make the following responses.<ol style="list-style-type: none">1) Turning ON/OFF of 2nd travel speed indicator2) Changing sound by buzzer (Short sound)
Relative information	

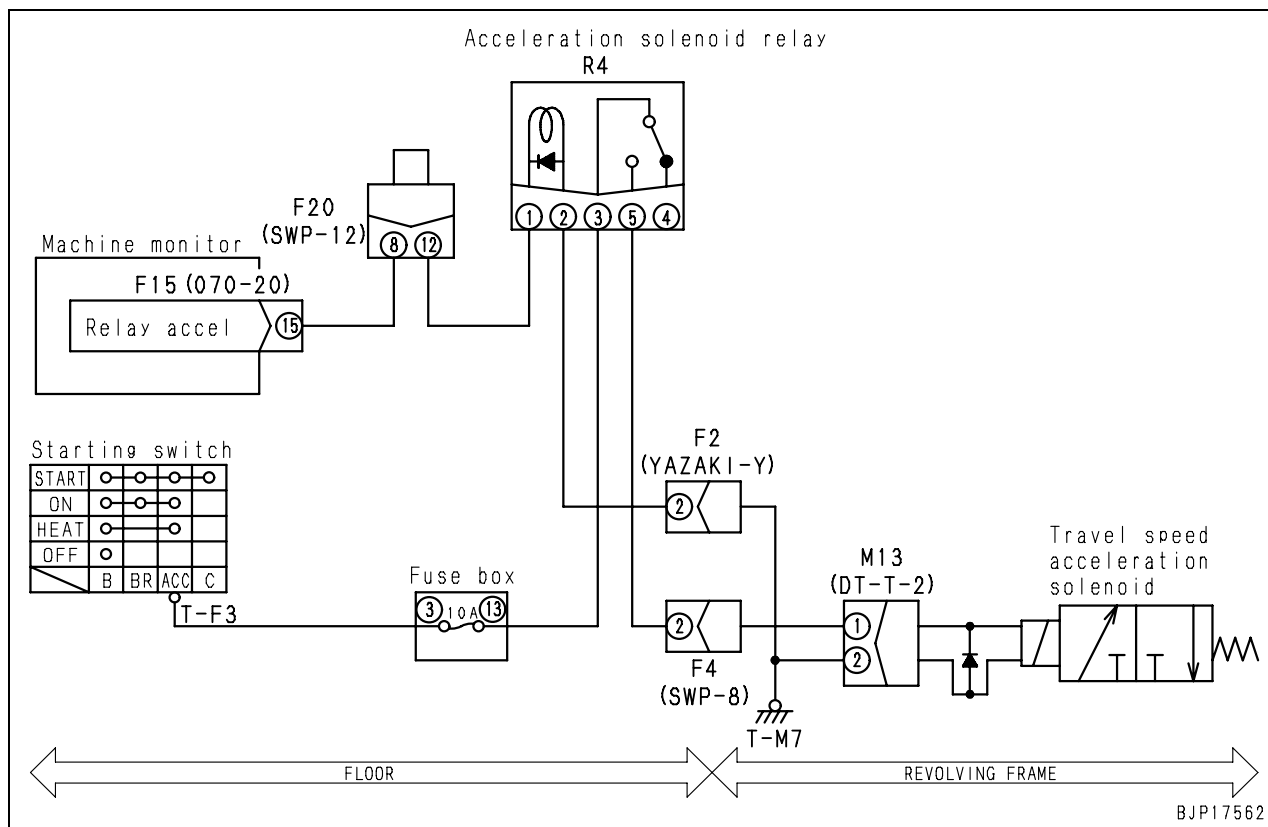
★ Carry out troubleshooting E-3.

2) Monitor panel responds but 2nd travel speed is not selected

Failure information	<ul style="list-style-type: none"> Monitor panel responds but 2nd travel speed is not selected.
Relative information	<ul style="list-style-type: none"> Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective fuse (3) – (13)	If the fuse is burned, the circuit probably has a grounding fault.			
	2	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect negative (–) terminal of battery.			
			Starting switch	Position	Resistance	
			Between terminals B and ACC	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	3	Defective 2nd travel speed selection relay	1) Turn starting switch OFF. 2) Disconnect connector R4. 3) Connect T-adapter to R4 (male).			
			R4 (male)		Resistance	
			Between (1) and (2)		86 – 106 Ω	
			Between (3) and (4)		Max. 1 Ω	
			Between (3) and (5)		Min. 1 MΩ	
			1) Turn starting switch OFF. 2) Insert T-adapter in R4. 3) Turn starting switch ON.			
			R4	2nd travel speed selection switch	Voltage	
			Between (5) and ground	ON	10 – 15 V	
	4	Defective 2nd travel speed selection solenoid	1) Turn starting switch OFF. 2) Disconnect connector M13. 3) Connect T-adapter to M13 (male).			
			M13 (male)	Between (1) and (2)	Resistance	10.5 – 12 Ω
				Between (1) and body	Resistance	Min. 1 MΩ
	5	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect T-F3 and connectors F15, R4 and M13. 3) Connect T-adapter to F15, R4 and M13 (female).			
			Wiring harness between T-F3 and fuse (3) or between (13) and R4 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between R4 (female) (5), F4 (2) and M13 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between F15 (female) (15), F20 (8) (12) and R4 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between R4 (female) (2), F2 (2) and ground		Resistance	Max. 1 Ω
	6	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect T-F3 and connectors F15, R4 and M13. 3) Connect T-adapter to F15, R4 and M13 (female).			
			Between wiring harness between fuse (13) and R4 (female) (3) and ground		Resistance	Min. 1 MΩ
			Between wiring harness between R4 (female) (5), F4 (2) and M13 (female) (1) and ground		Resistance	Min. 1 MΩ
Between wiring harness between F15 (female) (15), F20 (8) (12) and R4 (female) (1) and ground			Resistance	Min. 1 MΩ		

Related circuit diagram

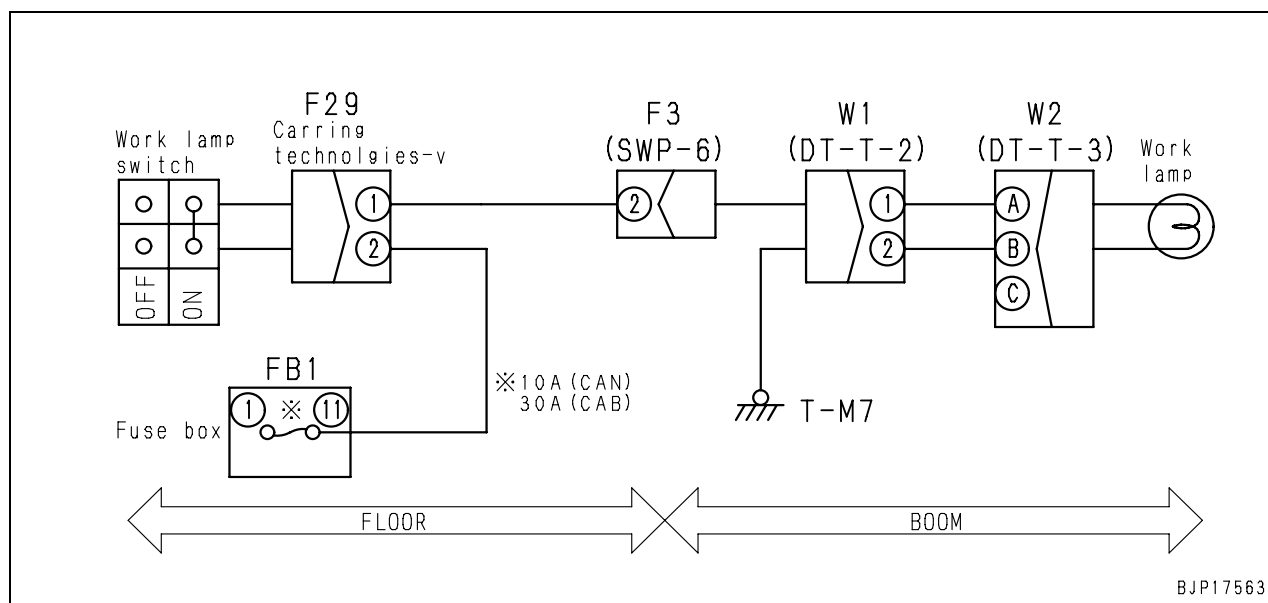


E-13 Working lamp does not light up

Failure information	<ul style="list-style-type: none"> Working lamp does not light up.
Relative information	<ul style="list-style-type: none"> Refer to troubleshooting E-3, too.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective fuse (1) – (11)	If the fuse is burned, the circuit probably has a grounding fault.		
	2	Defective lamp	1) Turn starting switch OFF. 2) Disconnect connector W2. 3) Connect T-adapter to W2 (female). 4) Turn starting switch ON. 5) Turn lamp switch ON.		
			Between W2 (female) (A) and ground	Voltage	10 – 15 V
	3	Defective lamp switch	1) Turn starting switch OFF. 2) Disconnect relay F29.		
			F29 (female)	Light switch operation	Resistance
			Between (1) and (2)	(1) and (2) ON	Max. 1 Ω
				(3) and (4) OFF	Min. 1 MΩ
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connectors F29 and W2. 3) Connect T-adapter to W2 (female).		
			Wiring harness between fuse (11) and F29 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between F29 (female) (1), F3 (2), W1 (1) and W2 (female) (A)	Resistance	Max. 1 Ω
	5	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connectors F29 and W2. 3) Connect T-adapters to W2 (female).		
			Between wiring harness between fuse (11) and ground	Resistance	Min. 1 MΩ
			Between wiring harness between F29 (female) (1), F3 (2), W1 (1) and W2 (female) (A) and ground	Resistance	Min. 1 MΩ

Related circuit diagram



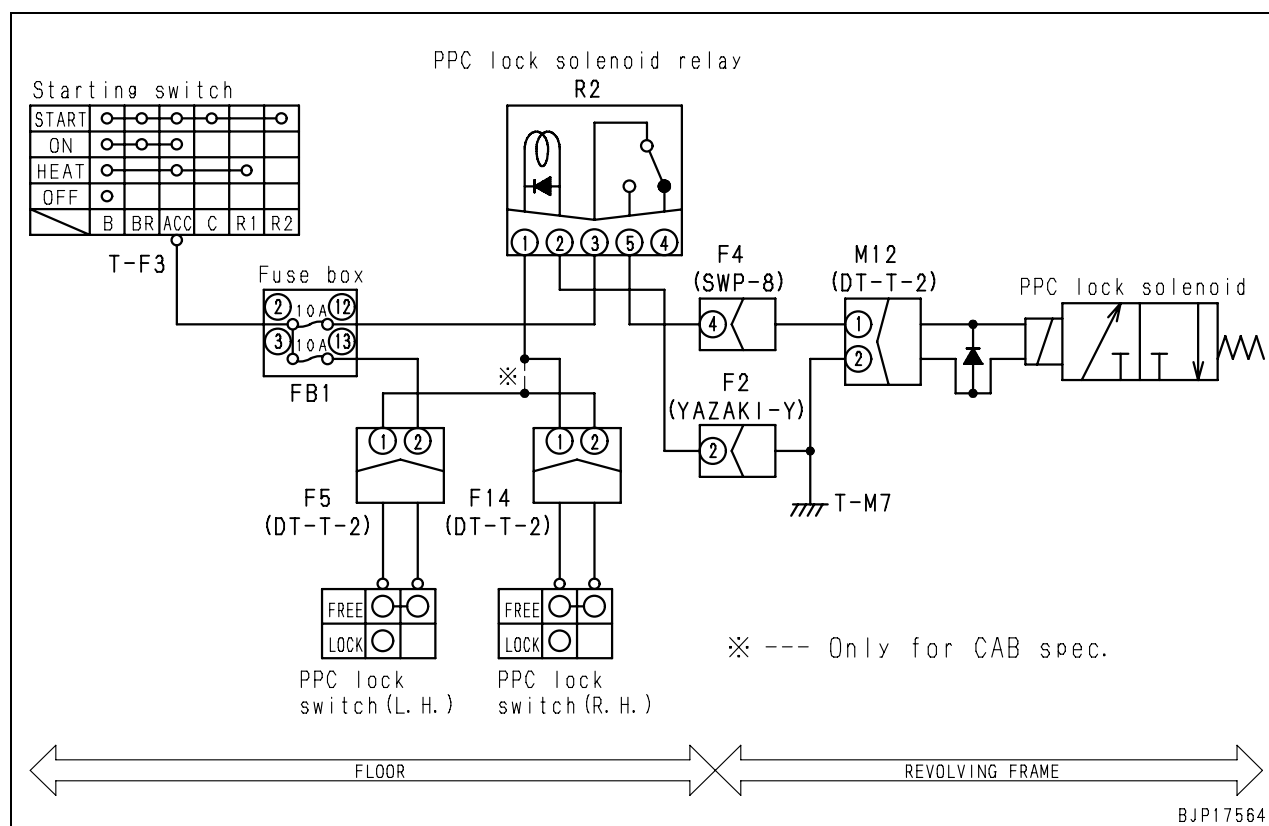
E-14 When work equipment lock (PPC basic pressure lock) lever is set in LOCK, work equipment still moves

Failure information	• When work equipment lock (PPC basic pressure lock) lever is set in LOCK, work equipment still moves.
Relative information	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting				
	1	Defective fuse (2) – (12), (3) – (13)	If fuse is broken, circuit probably has ground fault.				
	2	Defective starting switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect cable from negative (–) terminal of battery.				
			Starting switch		Position	Resistance	
			Between (T-F1) terminal B – (T-F3) terminal ACC	OFF		Min. 1 MΩ	
				ON		Max. 1 Ω	
	3	Defective PPC lock switch (left) (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect connector F5. 3) Connect T-adapter to F5 (male).				
			F5 (male)		Lock lever position	Resistance	
			Between (1) – (2)	Reset		Max. 1 Ω	
				Lock		Min. 1 MΩ	
	4	Defective PPC lock switch (right) (Internal defective contact) ★ Canopy specification only	1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter to F14 (male).				
			F14 (male)		Lock lever position	Resistance	
			Between (1) – (2)	Reset		Max. 1 Ω	
				Lock		Min. 1 MΩ	
	5	Defective PPC lock relay (Internal disconnection, defective contact or sticking)	1) Turn starting switch OFF. 2) Disconnect relay R2. 3) Connect T-adapter to R2 (male).				
			R2 (male)			Resistance	
			Between (1) – (2)			86 – 106 Ω	
			Between (3) – (4)			Max. 1 Ω	
			Between (3) – (5)			Min. 1 MΩ	
			1) Turn starting switch OFF. 2) Insert T-adapter in relay R2. 3) Turn starting switch ON.				
			R2		Lock lever position	Voltage	
			Between (5) – ground		Lock	10 – 15 V	
	6	Defective PPC lock solenoid (Internal disconnection or short circuit)	1) Turn starting switch OFF. 2) Disconnect connector M12. 3) Connect T-adapter to M12 (male).				
			M12 (male)	Between (1) – (2)		Resistance	10.5 – 12 Ω
				Between (1) – body		Resistance	Min. 1 MΩ

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	7	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Wiring harness between (T-F3) terminal ACC – fuse (12) – R2 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between R2 (female) (5) – F4 (4) – M12 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between (T-F3) terminal ACC – fuse (13) – F5 (2) or between (1) – F14 (2) or between (1) – R2 (female) (1) ★ F14 is installed to only canopy specification.	Resistance	Max. 1 Ω
	8	Ground fault in wiring harness (Contact with GND or GND circuit)	1) Turn starting switch OFF. 2) Disconnect related connector. 3) Set PPC lock switch in LOCK.		
			Between wiring harness fuse (12) – R2 (female) (3) and ground	Resistance	Min. 1 MΩ
			Between wiring harness R2 (female) (5) – F4 (4) – M12 (female) (1) and ground	Resistance	Min. 1 MΩ
			Between wiring harness fuse (13) – F5 (2) or (1) – F14 (2) or (1) – R2 (female) (1) and ground ★ F14 is installed to only canopy specification.	Resistance	Min. 1 MΩ

Related circuit diagram

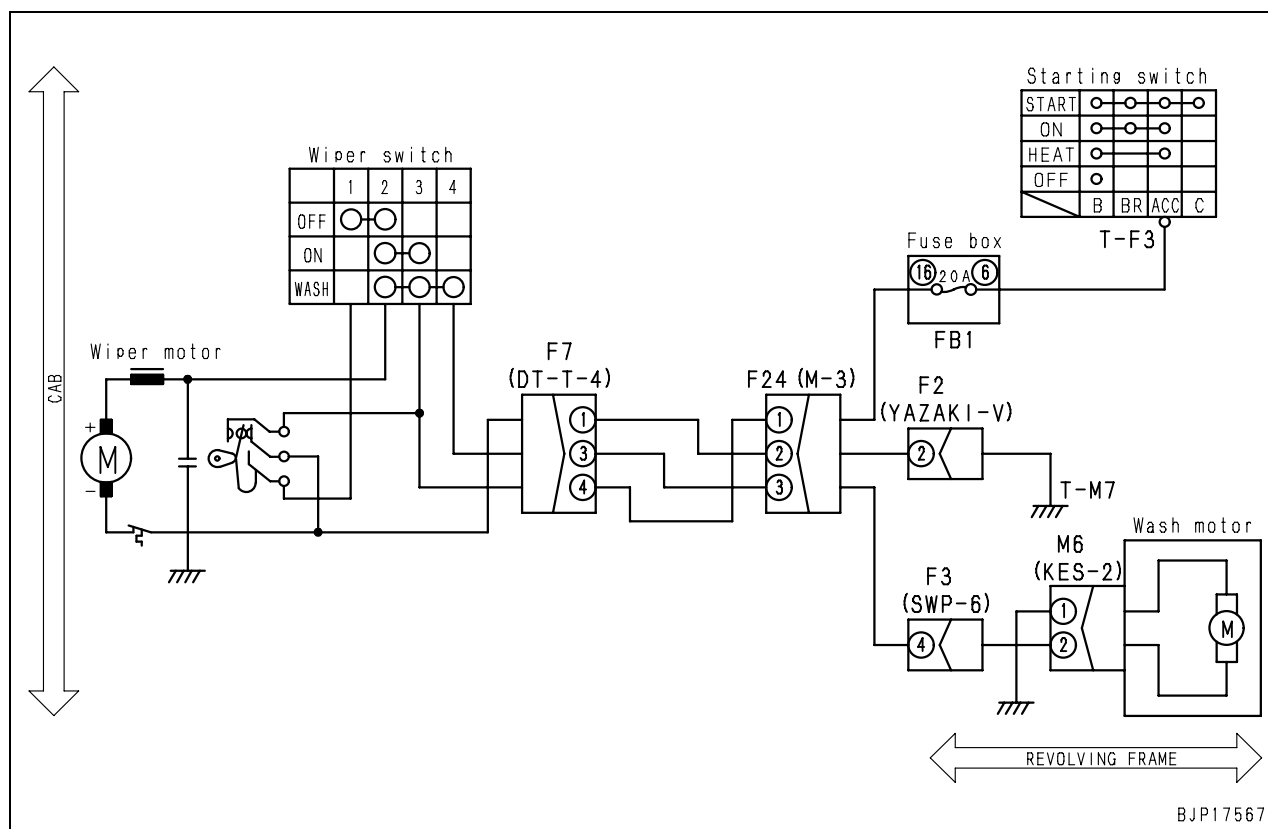


E-15 Windshield wiper does not operate

Failure information	<ul style="list-style-type: none"> Windshield wiper does not operate.
Relative information	<ul style="list-style-type: none"> The engine can start. (If the engine cannot start, carry out troubleshooting E-1 first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective fuse (6) – (16)	If the fuse is broken, the circuit probably has a grounding fault.			
	2	Defective wiper switch (Internal disconnection or defective contact)	1) Turn starting switch OFF. 2) Disconnect connector wiper switch terminal.			
			Wiper switch	Position	Resistance	
			Between terminals (1) and (2)	OFF (Do not move)	Max. 1 Ω	
			Between terminals (2) and (3)	ON (1st position)	Max. 1 Ω	
			Between terminals (2) and (3)	WASH (2nd position)	Max. 1 Ω	
			1) Turn starting switch from OFF to ON for troubleshooting.			
			Wiper switch	Position	Voltage	
			Between terminal (2) and ground	ON (1st position)	10 – 15 V	
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect wiper switch terminal.			
			Wiring harness between fuse (16), F24 (1), F7 (4) and wiper switch terminal (3)		Resistance	Max. 1 Ω
			Wiring harness between wiper switch terminal (2) and wiper motor (+) side		Resistance	Max. 1 Ω
			Wiring harness between wiper motor (–) side, F7 (1), F24 (2), F2 (2) and ground		Resistance	Max. 1 Ω
	4	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect wiper switch terminal.			
			Between wiring harness between fuse (16), F24 (1), F7 (4) and wiper switch terminal (3) and ground		Resistance	Min. 1 MΩ
			Between wiring harness between wiper switch terminal (2) and wiper motor (+) side and ground		Resistance	Min. 1 MΩ

Related circuit diagram

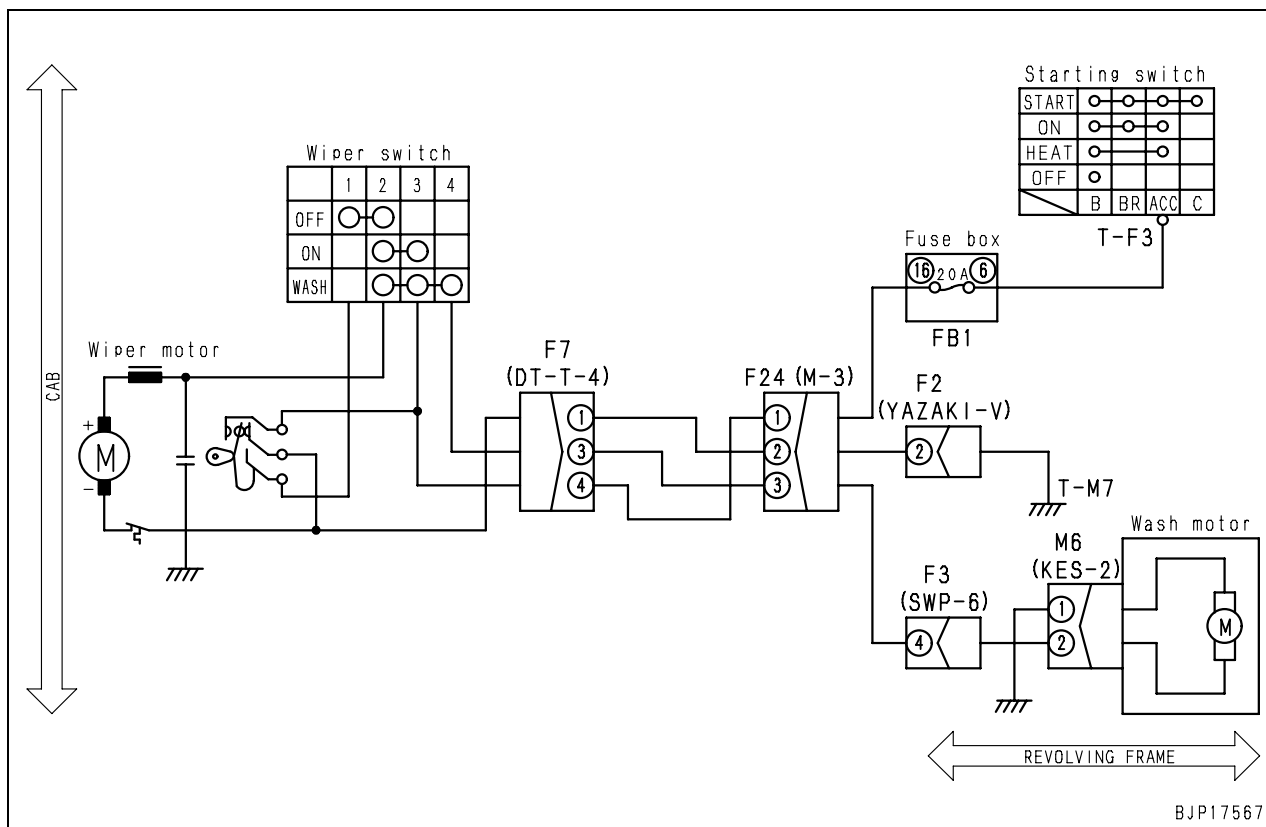


E-16 Windshield washer does not operate

Failure information	<ul style="list-style-type: none"> Windshield washer does not operate.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check the liquid level in the tank. The windshield wiper operates. (If the windshield wiper does not operate, carry out troubleshooting E-15 first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective washer motor (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect connector M6.		
			Between M6 (female) (1) and ground	Resistance	Min. 1 MΩ
			1) Turn starting switch OFF. 2) Connect T-adapter to M6 (female). 3) Turn starting switch ON.		
			Between M6 (female) (2) and ground	Voltage	10 – 15 V
	2	Defective wiper switch (Internal defective contact)	1) Turn starting switch OFF. 2) Disconnect wiper switch terminal.		
			Wiper switch	Position	Resistance
			Between terminals (3) and (4)	WASH (2nd position)	Max. 1 Ω
			1) Turn starting switch from OFF to ON for troubleshooting.		
			Wiper switch	Position	Voltage
			Between terminal (4) and ground	WASH (2nd position)	10 – 15 V
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	1) Turn starting switch OFF. 2) Disconnect connector M6 and switch terminal. 3) Connect T-adapter to M6 (female).		
			Wiring harness between M6 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4)	Resistance	Max. 1 Ω
			Wiring harness between M6 (female) (1) and ground	Resistance	Max. 1 Ω
	4	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	1) Turn starting switch OFF. 2) Disconnect connector M6 and switch terminal 3) Connect T-adapter to M6 (female).		
			Between wiring harness between M6 (female) (2), F3 (4), F24 (3), F7 (3) and wiper switch terminal (4) and ground	Resistance	Min. 1 MΩ

Related circuit diagram



E-17 Defective air conditioner**1) Air conditioner does not operate**

Failure information	<ul style="list-style-type: none"> Air conditioner does not operate.
Relative information	<ul style="list-style-type: none"> Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal. When the blower switch is turned ON (in the 1, 2, or 3 position), the air conditioner switch is turned ON. If air does not blow out, carry out troubleshooting for "2) Air does not blow out or air flow rate does not change" first.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective air conditioner switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Air conditioner switch connector	Operation of switch	Resistance
			C – D	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the continuity between connectors.		Resistance Max. 1 Ω
	3	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)		Resistance Min. 1 MΩ
	4	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace control amplifier with normal one.	Condition becomes normal.	Control amplifier is defective.
				Condition does not become normal.	Control amplifier is normal.

2) Air does not blow out or air flow rate does not change

Failure information	<ul style="list-style-type: none"> Air does not blow out or air flow rate does not change.
Relative information	<ul style="list-style-type: none"> Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

	Causes		Standard value in normalcy and references for troubleshooting		
Presumed cause and standard value in normalcy	1	Defective blower switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Position of knob	Blower switch terminal	Resistance
			0	Between all terminals	Min. 1 MΩ
			1	Between B and L/R, between B and L/W, and between L/R and L/W	Max. 1 Ω
				Between terminals other than above	Min. 1 MΩ
			2	Between B and L/R, between B and L/Y, and between L/R and L/Y	Max. 1 Ω
				Between terminals other than above	Min. 1 MΩ
			3	Between B and L/R, between B and L/B, and between L/R and L/B	Max. 1 Ω
				Between terminals other than above	Min. 1 MΩ
	2	Defective resistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Resistor terminals		Resistance
			Between L and M1		Approx. 1.8 Ω
			Between M1 and M2		Approx. 0.7 Ω
			Between M2 and M0		Approx. 0.3 Ω
	3	Defective blower motor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace blower motor with normal one.	Condition becomes normal.	Blower motor is defective.
				Condition does not become normal.	Blower motor is normal.
	4	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the continuity between connectors.		Resistance Max. 1 Ω
	5	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)		Resistance Min. 1 MΩ
	6	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace control amplifier with normal one.	Condition becomes normal.	Control amplifier is defective.
				Condition does not become normal.	Control amplifier is normal.

3) Blowing air temperature cannot be adjusted

Failure information	<ul style="list-style-type: none"> Blowing air temperature cannot be adjusted.
Relative information	<ul style="list-style-type: none"> Check in advance that hot water is supplied to the inlet side of the water valve. Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

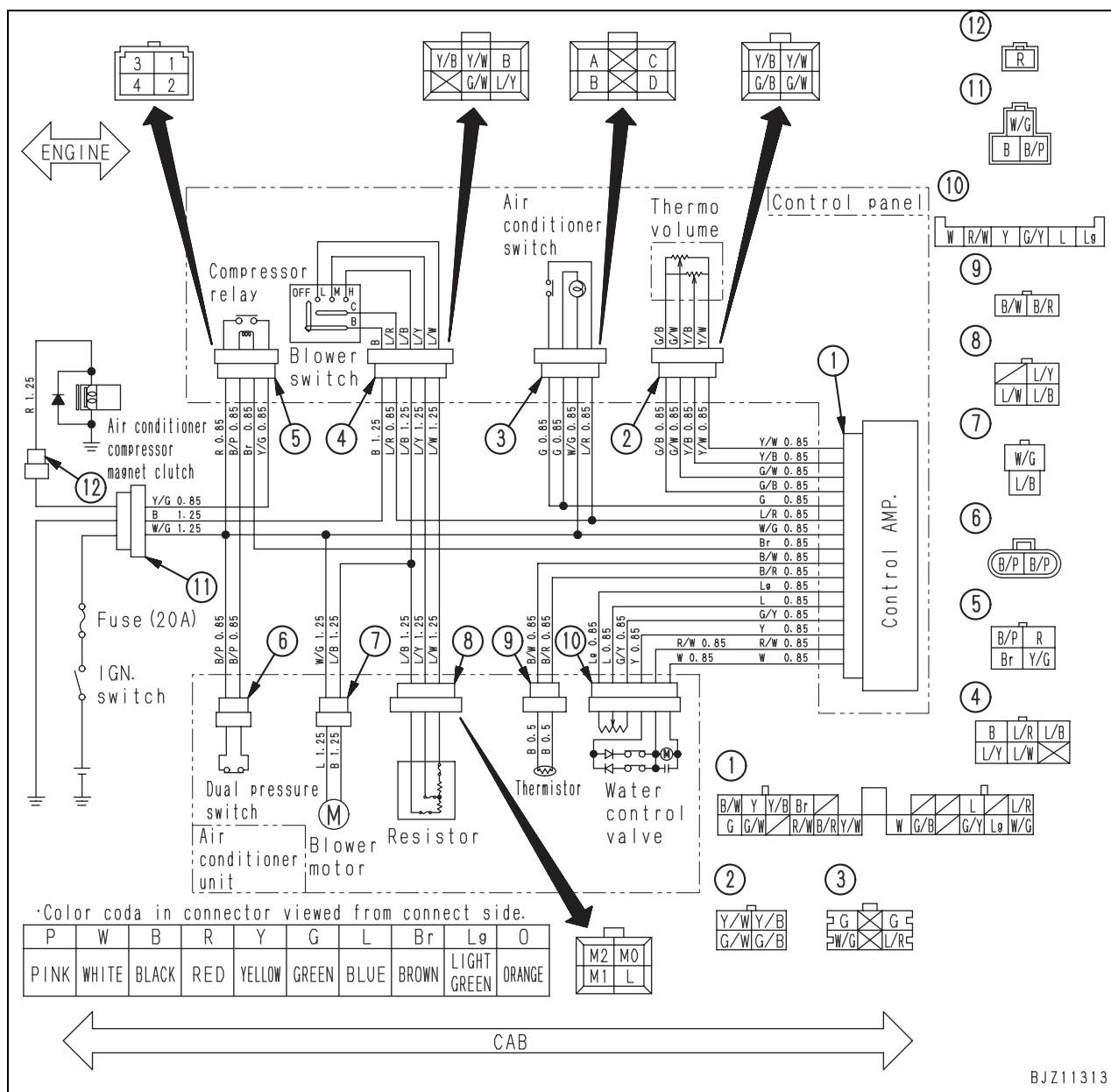
Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective temperature regulator switch	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. ★ Turn blower switch ON (Set it to the 1, 2, or 3 position) and carry out troubleshooting.			
			Temperature regulator switch connector (2)		Voltage	
			G/B – G/W		Changes between 0 and approx. 5 V.	
			G/B – Y/B		Changes between 0 and approx. 5 V.	
			G/B – Y/W		Approx. 5 V	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			Temperature regulator switch connector (2) (Switch side)	Operation of knob	Resistance	
			Y/W – Y/B	COOL-MAX → Middle position	Approx. 2.3 kΩ → Max. 1 Ω	
				Middle position → HOT-MAX	Max. 1 Ω	
			Y/W – G/W	COOL-MAX → Middle position	Approx. 2.3 kΩ	
				Middle position → HOT-MAX	Approx. 2.3 kΩ → Max. 1 Ω	
	2	Defective water valve assembly	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. ★ Turn blower switch ON (Set it to the 1, 2, or 3 position) and carry out troubleshooting.			
			Operation	Rod operates according to operation of temperature regulator switch.		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace water valve assembly with normal one.	Condition becomes normal.	Water valve assembly is defective.	
				Condition does not become normal.	Water valve assembly is normal.	
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			Referring to the circuit diagram, check the continuity between connectors.		Resistance	Max. 1 Ω
	4	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)		Resistance	Min. 1 MΩ
	5	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace control amplifier with normal one.	Condition becomes normal.	Control amplifier is defective.	
Condition does not become normal.				Control amplifier is normal.		

4) Blowing air is not cooled or temperature cannot be adjusted (Electrical system)

Failure information	<ul style="list-style-type: none"> Blowing air is not cooled or temperature cannot be adjusted (Electrical system).
Relative information	<ul style="list-style-type: none"> When the ambient temperature is below 2°C, this phenomenon is not a trouble. Check in advance that the fuse is normal and the continuity of the wiring harnesses between the connectors is normal.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective compressor clutch	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between (12) and chassis ground	Voltage	10 – 15 V
	2	Defective dual pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Dual pressure switch connector	Resistance	Max. 1 Ω
	3	Defective air conditioner switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Air conditioner switch connector	Operation of switch	Resistance
			C – D	ON	Max. 1 Ω
				OFF	Min. 1 MΩ
	4	Defective compressor relay	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Compressor relay connector		Resistance
			(1) – (2)		Approx. 320 Ω
			Compressor relay connector	Source voltage between (1) and (2)	Resistance
			(3) – (4)	When applied	Max. 1 Ω
				When not applied	Min. 1 MΩ
	5	Defective thermistor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Thermistor connector	Inspection temperature	Resistance
			B/W – B/R	0°C	Approx. 7.2 Ω
				25°C	Approx. 2.2 Ω
	6	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the continuity between connectors.	Resistance	Max. 1 Ω
	7	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Referring to the circuit diagram, check the insulation between each connector and chassis ground. (Do not check the ground circuit.)	Resistance	Min. 1 MΩ
	8	Defective control amplifier	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace control amplifier with normal one.	Condition becomes normal.	Control amplifier is defective.
				Condition does not become normal.	Control amplifier is normal.

Related circuit diagram



5) Defective cooling (Mechanical system)

Failure information	• Defective cooling (Mechanical system)
Relative information	—

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Gas leakage from pipe joint or piping part	Check. If abnormality is detected, repair or replace.
	2	Natural leakage from hoses, etc. (Refrigerant has not been added for long period)	Check quantity of refrigerant. If insufficient, add proper amount of refrigerant.
	3	Insufficient charge with refrigerant	Charge with refrigerant to proper level.
	4	Defective expansion valve	Check. If abnormality is detected, repair or replace. ★ Check that the valve is not opened too wide. Check thermometer tube for defective contact.
	5	Clogging of low-pressure circuit or evaporator	Check. If any part is clogged, repair or replace.
	6	Clogging of evaporator fins	Check. If evaporator fins are clogged, clean them.
	7	Clogging of filter	Check, then clean or replace.
	8	Defective installation of thermistor	Check. If abnormality is detected, repair or replace.
	9	Air leakage from air conditioner unit or duct joint	Check. If leakage is detected, repair or replace.
	10	Insufficient set air flow	Increase the set air flow.
	11	Overcharging with refrigerant	Check quantity of refrigerant. If it is too much, reduce it to proper level.
	12	Air in system	Evacuate the system, then charge it with proper quantity of refrigerant and replace receiver drier.
	13	Clogging of condenser fins	Check. If condenser fins are clogged, clean them.
	14	Defective compression by compressor	Check. If abnormality is detected, repair or replace.
	15	Water in refrigerant circuit	Evacuate the system, then charge it with proper quantity of refrigerant and replace receiver drier.

6) Defective heating (Defective hot-water circuit)

Failure information	<ul style="list-style-type: none"> Defective heating (Defective hot-water circuit)
Relative information	<ul style="list-style-type: none"> Check that water is not leaking from the hot-water circuit. Check that air is blowing out of the air outlet.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Clogging of heater core fins	Check. If heater core fins are clogged, clean them. ★ If this item is the cause, both temperatures at the heater core hot-water inlet and outlet are high.
	2	Air leakage from air conditioner unit	Check. If leakage is detected, repair or replace. ★ If this item is the cause, both temperatures at the heater core hot-water inlet and outlet are high.
	3	Defective water control valve (Clogging or defect in valve)	Check. If clogging or defect is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is high and that at the heater core hot-water outlet is low.
	4	Clogging in heater core	Check. If clogging is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is high and that at the heater core hot-water outlet is low.
	5	Clogging up to heater core hot-water inlet	Check. If clogging is detected, repair or replace. ★ If this item is the cause, the temperatures at the heater core hot-water inlet is low.

7) Abnormal sound comes out

Failure information	<ul style="list-style-type: none"> Abnormal sound comes out.
Relative information	—

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Defective installation of case bolts (screws)	Check. If abnormality is detected, repair.
	2	Interference of fan case or breakage of fan	Check. If abnormality is detected, repair or replace.
	3	Foreign matter in blower motor or defective blower motor	Check. If abnormality is detected, remove foreign matter and repair or replace.
	4	Defective expansion valve	Check. If abnormal sound (blowing or leaking sound) comes out, replace valve.
	5	Looseness or wear of compressor V-belt	Check. If looseness or wear is detected, repair or replace.
	6	Improper quantity of refrigerant	Check quantity of refrigerant, then adjust it properly, if necessary.
	7	Defective compressor	Check. If abnormality is detected, repair or replace.

8) Water leaks

Failure information	• Water leaks.
Relative information	—

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Clogging of water drain opening in air conditioner unit	Check. If abnormality is detected, repair.
	2	Clogging, bend, defective installation, or hole of drain hose of air conditioner unit	Check. If abnormality is detected, repair or replace.
	3	Breakage (Cracking) of air conditioner unit case	Check. If breakage (cracking) is detected, repair or replace.
	4	Defective mounting bolt (screw) of air conditioner unit case	Check. If abnormality is detected, repair or replace.
	5	Defective joint of hot-water circuit piping	Check. If abnormality is detected, repair or replace.
	6	Defective heater core	Check. If abnormality is detected, repair or replace.
	7	Defective water valve	Check. If abnormality is detected, repair or replace.

9) External and internal air cannot be changed

Failure information	• External and internal air cannot be changed.
Relative information	—

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Malfunction of EXTERNAL/INTERNAL air changeover lever	Check. If abnormality is detected, clean, repair, or replace.
	2	Malfunction of intake damper	Check. If abnormality is detected, clean, repair, or replace.
	3	Clogging of external air intake duct of unit	Check. If abnormality is detected, clean.

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

40 Troubleshooting

300 Troubleshooting of hydraulic and mechanical system (H-mode)

Information contained in troubleshooting table	3
H1 Speed or power of whole work equipment, travel, swing, and blade is low.....	4
H-2 Engine speed lowers extremely or engine stalls	8
H-3 Whole work equipment, travel system, swing system, and blade do not work	9
H-4 Abnormal sound comes out from around hydraulic pump.....	13
H-5 Fine control performance or response is low	13
H-6 Speed or power of boom is low	14
H-7 Speed or power of arm is low	15
H-8 Speed or power of bucket is low	16
H-9 Speed or power of boom swing is low	17
H-10 Work equipment does not move singly	17
H-11 Work equipment hydraulic drift is large	18
H-12 Time lag of work equipment is large.....	20
H-13 In compound operation of work equipment, speed of part loaded more is low	20
H-14 Machine deviates during travel	21
H-15 Travel speed or travel power is low (while work equipment is normal)	23
H-16 Machine is not steered well or steering power is low	24
H-17 Travel speed does not change	25
H-18 Travel motor does not work.....	26
H-19 Speed or power of swing is low	28
H-20 Machine does not swing.....	30

H-21 Swing acceleration performance is low	32
H-22 Machine overruns when it stops swinging	34
H-23 Large shock is made when machine stops swinging	35
H-24 When upper structure stops swinging, it makes large sound	35
H-25 Hydraulic drift of swing is large	36
H-26 Speed or power of blade is low	37
H-27 Blade does not move	38
H-28 Hydraulic drift of blade is large	39

Information contained in troubleshooting table

- ★ Troubleshooting table collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

Failure information	Phenomena occurring on machine
Relative information	Information on occurred failures and troubleshooting

Presumed cause and standard value in normalcy	Cause		Standard value in normalcy and references for troubleshooting
	1	Cause for presumed failure (The attached No. for filing and reference purpose only. It does not stand for any priority)	<div><Contents></div> <ul style="list-style-type: none">• The standard values in normalcy by which to judge “good” or “no good” about presumed causes.• References for making judgement of “good” or “no good”
	2		
	3		
	4		
	5		

<Contents>

- The standard values in normalcy by which to judge “good” or “no good” about presumed causes.
- References for making judgement of “good” or “no good”

H1 Speed or power of whole work equipment, travel, swing, and blade is low

- ★ Check the combination of the systems which are low in speed or power according to the following table, then go to the specified troubleshooting item.

○: Normal
x: Low in speed or power

Whole work equipment	Travel	Swing	Blade	Trouble-shooting item
x	x	x	x	Go to 1)
x	x	○	○	Go to 2)
○	○	x	x	Go to 3)
x	○	○	x	Go to 4)
○	x	○	x	Go to 5)
x	○	○	○	Go to 6)

1) Speed or power of whole work equipment, travel, swing, and blade is low

Failure information	<ul style="list-style-type: none"> Speed or power of whole work equipment, travel, swing, and blade is low
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Before starting troubleshooting, check that the electric system (solenoid circuit) is normal. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of PPC basic pressure lock solenoid valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Position of work equipment lock lever	Solenoid valve output pressure
			LOCK	0 MPa {0 kg/cm ² }
			FREE	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Defective adjustment or malfunction of control circuit relief valve (PC35MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control levers	Control circuit relief pressure
			Set all levers in neutral	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the oil pressure does not become normal after adjustment, the control relief valve may have a malfunction or a defect in it. Check it directly.	
	3	Malfunction of self pressure reducing valve (PC27, 30MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control levers	Control circuit oil pressure
			Set all levers in neutral	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	4	Clogging of suction strainer	If the results of 1 – 3 are normal, the strainer may be clogged. Check it directly.	
	5	Defective control pump (PC35MR-3)	If the results of 1, 2, and 4 are normal, the control pump may be defective.	

2) Speed or power of whole work equipment and travel is low

Failure information	<ul style="list-style-type: none"> Speed or power of whole work equipment and travel is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment or malfunction of main relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control levers	Main relief pressure	
			<ul style="list-style-type: none"> Move arm IN to relieve its circuit. Drive machine to relieve travel circuit. 	PC27MR-3	$24.5 \pm \begin{smallmatrix} +0.98 \\ -0.49 \end{smallmatrix}$ MPa { $250 \pm \begin{smallmatrix} +10 \\ -5 \end{smallmatrix}$ kg/cm ² }
				PC30, 35MR-3	26 ± 0.98 MPa { 265 ± 10 kg/cm ² }
			If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.		
	2	Malfunction of unload valve ★ PC35MR-3 has 2 sets of this valve.	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control levers	Unload pressure	
			Set all levers in neutral	PC27, 30MR-3	3.9 MPa { $39.6 \pm \begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ kg/cm ² }
				PC35MR-3	$3.2 \pm \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ MPa { $33 \pm \begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ kg/cm ² }
	3	Defective adjustment or malfunction of LS valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Oil pressure to be measured	Differential pressure	
				Set all levers in neutral	Curl bucket with no load (Move lever to stroke end)
			Difference pressure between pump discharge pressure and LS valve input pressure	PC27MR-3 PC30MR-3	$3.9 \pm \begin{smallmatrix} +0.98 \\ 0 \end{smallmatrix}$ MPa { $39.6 \pm \begin{smallmatrix} +10 \\ 0 \end{smallmatrix}$ kg/cm ² }
				PC35MR-3	1.57 ± 0.1 MPa { 16 ± 1 kg/cm ² }
			If the oil pressure ratio does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.		
	4	Defective adjustment or malfunction of PC valve	Referring to Testing and adjusting, “Adjusting PC valve”, adjust the PC valve. If the oil pressure does not become normal after adjustment, the PC valve may have a malfunction or a defect in it. Check it directly.		
	5	Malfunction of servo piston	The servo piston may have a malfunction. Check it direction.		
	6	Defective piston pump	If any problem is not detected by the above checks, the cause may be lowering of performance, malfunction, or internal defect of the piston pump.		
	7	Malfunction of sequence valve (PC30MR-3)	If the fault does not disappear when the engine speed is increased, the sequence valve may have a malfunction. Check it directly.		

3) Speed or power of swing and blade is low

Failure information	<ul style="list-style-type: none"> Speed or power of swing and blade is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment or malfunction of gear pump relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever	Main relief pressure	
			Relieve blade lower circuit	PC27MR-3	20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3	21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
			If the oil pressure does not become normal after adjustment, the gear pump relief valve may have a malfunction or a defect in it. Check it directly.		
	2	Defective gear pump	If the condition does not become normal after the relief valve is adjusted or replaced, the performance of the gear pump may be lowered.		

4) Speed or power of whole work equipment and blade is low

Failure information	<ul style="list-style-type: none"> Speed or power of whole work equipment and blade is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective centralized safety valves	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever	Main pump pressure and gear pump relief pressure	
			• Work equipment control lever (Both directions) • Swing control lever (Right swing)	PC27MR-3	24.5 ^{+0.98} _{-0.49} MPa {250 ⁺¹⁰ ₋₅ kg/cm ² }
				PC30, 35MR-3	26.0 ± 0.98 MPa {265 ± 10 kg/cm ² }
			• Blade control lever (Lower)	PC27MR-3	20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3	21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
			If the oil pressure is lower through all of the above measurements, the centralized safety valves may be defective. Check them directly. ★ The centralized safety valves act on both sides of the boom, arm, and bucket, on the head side of the boom swing, and on the bottom side of the blade.		

5) Speed or power of travel and blade is low

Failure information	<ul style="list-style-type: none"> Speed or power of travel and blade is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective center swivel joint	1) Stop engine. 2) Plug control valve side of hydraulic hose to travel or blade system. 3) Run engine at full throttle.		
			Control lever	Main pump pressure and gear pump relief pressure	
			Travel lever (Side from which hose is disconnected)	PC27MR-3	24.5 ^{+0.98} _{-0.49} MPa {250 ⁺¹⁰ ₋₅ kg/cm ² }
				PC30, 35MR-3	26.0 ± 0.98 MPa {265 ± 10 kg/cm ² }
			Blade control lever (Side from which hose is disconnected)	PC27MR-3	20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3	21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
	If the oil pressure becomes normal during the above measurement, the center swivel joint may be defective. Check it directly.				

6) Speed or power of whole work equipment is low

Failure information	<ul style="list-style-type: none"> Speed or power of whole work equipment is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. If a phenomenon disappears as the engine speed is increased, it is not a fault.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective seal of check valve for receiving logic valve control circuit pressure (PC35MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Right and left control levers and boom swing control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			<ul style="list-style-type: none">• Operate boom, arm, and bucket in both directions.• Swing boom to right.	<div>2.94^{+0.49}_{-0.1} MPa</div> <div>{30⁺⁵₋₁ kg/cm²}</div>

H-2 Engine speed lowers extremely or engine stalls

Failure information	<ul style="list-style-type: none"> Engine speed lowers extremely or engine stalls.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting				
	1	Defective adjustment or malfunction of main relief valve pressure	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.				
			Control lever		Main relief pressure		
			Relieve arm circuit by moving arm IN	PC27MR-3		$24.5^{+0.98}_{-0.49}$ MPa { 250^{+10}_{-5} kg/cm ² }	
				PC30, 35MR-3		26.0 ± 0.98 MPa { 265 ± 10 kg/cm ² }	
			If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.				
	2	Defective adjustment or malfunction of LS valve	Oil pressure to be measured		Differential pressure		
					Set all levers in neutral		Curl bucket with no load (Move lever to stroke end)
			Difference pressure between pump discharge pressure and LS valve input pressure	PC27, 30MR-3	$3.9^{+0.98}_0$ MPa { 39.6^{+10}_0 kg/cm ² }		1.57 ± 0.1 MPa { 16 ± 1 kg/cm ² }
				PC35MR-3	$3.2^{+0.98}_0$ MPa { 33^{+10}_0 kg/cm ² }		1.41 ± 0.1 MPa { 14.4 ± 1 kg/cm ² }
			If the oil pressure does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.				
	3	Defective adjustment or malfunction of PC valve	Referring to Testing and adjusting, “Adjusting PC valve”, adjust the PC valve. If the oil pressure does not become normal after adjustment, the PC valve may have a malfunction or a defect in it. Check it directly.				
	4	Clogging of orifice or filter in servo mechanism	The orifice or filter in the servo mechanism may be clogged. Check them directly.				
	5	Malfunction of servo piston	The servo piston may have a malfunction. Check it directly.				
	6	Defective adjustment or malfunction of gear pump relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.				
			Blade control lever		Gear pump relief pressure		
			Relieve blade lower circuit	PC27MR-3		20.6 ± 0.98 MPa { 210 ± 10 kg/cm ² }	
PC30, 35MR-3				$21.6^{+0.98}_{-0.49}$ MPa { 220^{+10}_{-5} kg/cm ² }			
If the oil pressure does not become normal after adjustment, the relief valve may have a malfunction or a defect in it. Check it directly.							
7	Lowering of engine output	If any problem is not detected by checks 1 – 6 above, the cause may be lowering of the engine output. Carry out troubleshooting “S-6 Engine lacks output (or lacks power)” in Troubleshooting of engine (S-mode).					

H-3 Whole work equipment, travel system, swing system, and blade do not work

- ★ Check the systems which do not work according to the following table, then go to the specified trouble-shooting item.

○: Normal
x: Does not work

Whole work equipment	Travel	Swing	Blade	Trouble-shooting item
x	x	x	x	Go to 1)
x	x	○	○	Go to 2)
○	○	x	x	Go to 3)
x	○	○	x	Go to 4)
○	x	○	x	Go to 5)
x	○	○	○	Go to 6)

1) Whole work equipment, travel system, swing system, and blade do not work

Failure information	<ul style="list-style-type: none"> Whole work equipment, travel system, swing system, and blade do not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Before starting troubleshooting, check that the electric system (solenoid circuit) is normal.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of PPC basic pressure lock solenoid valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Position of work equipment lock lever	Solenoid valve output pressure
			LOCK	0 MPa {0 kg/cm ² }
			FREE	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Defective adjustment or malfunction of control circuit relief valve (PC35MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control levers	Control circuit relief pressure
			Set all levers in neutral	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the oil pressure does not become normal after adjustment, the control relief valve may have a malfunction or a defect in it. Check it directly.	
	3	Malfunction of self pressure reducing valve (PC27, 30MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control levers	Control circuit oil pressure
			Set all levers in neutral	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	4	Clogging of suction strainer	If the results of 1 – 3 are normal, the strainer may be clogged. Check it directly.	
	5	Defective control pump (PC35MR-3)	If the results of 1, 2, and 4 are normal, the control pump may be defective.	
	6	Defective piston pump drive shaft or damper	Disconnect the discharge hose from the main pump, crank the engine with the starting motor, and check that oil flows out of the discharge port.	

2) Whole work equipment and travel system do not work

Failure information	<ul style="list-style-type: none"> Whole work equipment and travel system do not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective adjustment or malfunction of main relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control lever	Main relief pressure
			<ul style="list-style-type: none"> Move arm IN to relieve its circuit. Drive machine to relieve travel circuit. 	PC27MR-3 $24.5^{+0.98}_{-0.49}$ MPa $\{250^{+10}_{-5}$ kg/cm ² $\}$
				PC30, 35MR-3 26.0 ± 0.98 MPa $\{265 \pm 10$ kg/cm ² $\}$
			If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check it directly.	
	2	Defective piston pump	Disconnect pump discharge hose and crank the engine with the starting motor and see if oil flows out of the discharge port.	

3) Swing and blade systems do not work

Failure information	<ul style="list-style-type: none"> Swing and blade systems do not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective adjustment or malfunction of gear pump relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control lever	Main pump pressure
			Relieve blade circuit by lowering blade	PC27MR-3 20.6 ± 0.98 MPa $\{210 \pm 10$ kg/cm ² $\}$
				PC30, 35MR-3 $21.6^{+0.98}_{-0.49}$ MPa $\{220^{+10}_{-5}$ kg/cm ² $\}$
			If the oil pressure does not become normal after adjustment, the gear pump relief valve may have a malfunction or a defect in it. Check it directly.	
	2	Defective gear pump drive shaft or coupling	Disconnect gear pump discharge hose and crank the engine with the starting motor and see if oil flows out of the discharge port.	

4) Whole work equipment and blade do not work

Failure information	<ul style="list-style-type: none"> Whole work equipment and blade do not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective centralized safety valves	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever	Main relief pressure and gear pump relief pressure	
			• Work equipment control lever (Both directions) • Boom swing control lever (Swing to right)	PC27MR-3	24.5 ^{+0.98} _{-0.49} MPa {250 ⁺¹⁰ ₋₅ kg/cm ² }
				PC30, 35MR-3	26 ± 0.98 MPa {265 ± 10 kg/cm ² }
			• Blade control lever (Lower)	PC27MR-3	20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3	21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
			If the oil pressure is lower through all of the above measurements, the centralized safety valves may be defective. Check them directly. ★ The centralized safety valves act on both sides of the boom, arm, and bucket, on the head side of the boom swing, and on the bottom side of the blade.		

5) Travel system and blade system do not work

Failure information	<ul style="list-style-type: none"> Travel system and blade system do not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective center swivel joint	1) Stop engine. 2) Plug control valve side of hydraulic hose to travel or blade system. 3) Run engine at full throttle.		
			Control lever	Main pump pressure and gear pump relief pressure	
			Travel lever (on the side where hose is disconnected)	PC27MR-3	24.5 ^{+0.98} _{-0.49} MPa {250 ⁺¹⁰ ₋₅ kg/cm ² }
				PC30, 35MR-3	26.0 ^{+0.98} _{-0.49} MPa {265 ⁺¹⁰ ₋₅ kg/cm ² }
			Blade lever (on the side where hose is disconnected)	PC27MR-3	20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3	21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
			If the oil pressure becomes normal during the above measurement, the center swivel joint may be defective. Check it directly.		

6) Whole work equipment does not work

Failure information	<ul style="list-style-type: none"> Whole work equipment does not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective seal of check valve for receiving logic valve control circuit pressure (PC35MR-3)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Right and left control levers and boom swing control pedal	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			<ul style="list-style-type: none"> Operate boom, arm, and bucket in both directions. Swing boom to right. 	$2.94^{+0.49}_{-0.1}$ MPa { 30^{+5}_{-1} kg/cm ² }

H-4 Abnormal sound comes out from around hydraulic pump

Failure information	<ul style="list-style-type: none"> Abnormal sound comes out from around hydraulic pump.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Lowering of hydraulic oil level	Check directly.
	2	Trouble of hydraulic oil	Hydraulic oil may contain air. Check it directly.
	3	Clogging of hydraulic tank cap	The hydraulic tank cap may be clogged and negative pressure may be applied to the hydraulic tank. Check the cap directly.
	4	Clogging of hydraulic tank strainer	The hydraulic tank strainer may be clogged and negative pressure may be applied to the suction circuit. Check the strainer directly.
	5	Defective main pump	The main pump may have a defect in it. Check it directly.
	★ If the results of 1 – 5 above are normal, operate the machine for a while and see if the condition changes.		

H-5 Fine control performance or response is low

Failure information	<ul style="list-style-type: none"> Fine control performance or response is low.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Clogging of LS circuit orifice	The LS circuit orifice may be clogged. Check it directly.			
	2	Defective adjustment or malfunction of LS valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Oil pressure to be measured		Differential pressure	
					Set all levers in neutral	Curl bucket with no load (Move lever to stroke end)
			Difference pressure between pump discharge pressure and LS valve input pressure	PC27, 30 MR-3	$3.9^{+0.98}_0$ MPa { 39.6^{+10}_0 kg/cm ² }	1.57 ± 0.1 MPa { 16 ± 1 kg/cm ² }
				PC35MR-3	$3.2^{+0.98}_0$ MPa { 33^{+10}_0 kg/cm ² }	1.41 ± 0.1 MPa { 14.4 ± 1 kg/cm ² }
	If the oil pressure ratio does not become normal after adjustment, the LS valve may have a malfunction or a defect in it. Check it directly.					
	3	Malfunction of servo piston	The servo piston may have a malfunction. Check it directly.			
	4	Malfunction of unload valve ★ PC35MR-3 has 2 sets of this valve.	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Control levers	Machine model	Unload pressure	
			Set all levers in neutral	PC27, 30MR-3	$3.9^{+0.98}_0$ MPa { 39.6^{+10}_0 kg/cm ² }	
PC35MR-3				$3.2^{+0.98}_0$ MPa { 33^{+10}_0 kg/cm ² }		
5	Clogging of piston pump orifice plug	If the results of 1 – 4 above are normal, the piston pump orifice plug may be clogged. Check it directly.				

H-6 Speed or power of boom is low

Failure information	<ul style="list-style-type: none"> Speed or power of boom is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of right PPC valve (boom circuit)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Right work equipment control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to raise boom Operate to lower boom	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of boom control valve (spool)	The boom control valve spool may have a malfunction. Check it directly.	
	3	Malfunction of boom control valve (pressure compensation valve)	The pressure compensation valve of the boom control valve may be malfunction. Check it directly.	
	4	Malfunction of boom control valve (lock valve) (PC35MR-3)	The lock valve of the boom control valve may be malfunction. Check it directly.	
	5	Malfunction or defective seal of boom control valve (suction valve)	The suction valve (bottom side) of the boom control valve may have a malfunction or defective seal. Check it directly.	
	6	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.	
	7	Defective boom cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Boom cylinder	Leakage from cylinder
			Relieve by raising boom	10 cc/min

H-7 Speed or power of arm is low

Failure information	<ul style="list-style-type: none"> Speed or power of arm is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of left PPC valve (arm circuit)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operated to move arm IN Operated to move arm OUT	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of arm control valve (spool)	The arm control valve spool may have a malfunction. Check it directly.	
	3	Malfunction of arm control valve (pressure compensation valve)	The pressure compensation valve of the arm control valve may be malfunction. Check it directly.	
	4	Malfunction or defective seal of arm control valve (suction valve)	Since the suction valves of the arm control valve (on the bottom side and head side) may have a malfunction, check them directly.	
	5	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.	
	6	Defective arm cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Arm cylinder	Leakage from cylinder
			Relieved in arm-IN operation	10 cc/min

H-8 Speed or power of bucket is low

Failure information	<ul style="list-style-type: none"> Speed or power of bucket is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of right PPC valve (bucket circuit)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Right work equipment control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operated to move CURL bucket Operated to move bucket DUMP	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of bucket control valve (spool)	The bucket control valve spool may have a malfunction. Check it directly.	
	3	Malfunction of bucket control valve (pressure compensation valve)	The pressure compensation valve of the bucket control valve may be malfunction. Check it directly.	
	4	Malfunction or defective seal of bucket control valve (suction valve)	Since the suction valves of the bucket control valve (on the bottom side and head side) may have a malfunction, check them directly.	
	5	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.	
	6	Defective bucket cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Bucket cylinder	Leakage from cylinder
			Relieved in bucket-CURL operation	10 cc/min

H-9 Speed or power of boom swing is low

Failure information	<ul style="list-style-type: none"> Speed or power of boom swing is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of boom swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Boom swing control pedal	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Swing boom to right or left	2.94 ^{+0.49} / _{-0.1} MPa {30 ⁺⁵ / ₋₁ kg/cm ² }
	2	Malfunction of boom swing control valve (spool)	The boom swing control valve spool may have a malfunction. Check it directly.	
	3	Malfunction of boom swing control valve (pressure compensation valve)	The pressure compensation valve of the boom swing control valve may have a malfunction. Check it directly.	
	4	Malfunction or defective seal of boom swing control valve (suction valve) ★ Only right swing	The suction valve (head side) of the boom swing control valve may have a malfunction. Check it directly.	
	5	Malfunction or defective seal of centralized safety-suction valves	The centralized safety-suction valves of the control valve may have a malfunction or defective seal. Check them directly.	
	6	Defective boom swing cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Boom swing cylinder	Leakage from cylinder
			Relieve at left end	10 cc/min

H-10 Work equipment does not move singly

Failure information	<ul style="list-style-type: none"> Work equipment does not move singly (while any part moves normally). 	(1) Boom does not move singly. (2) Arm does not move singly. (3) Bucket does not move singly. (4) Boom swing system does not move singly.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. 	

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Work equipment control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate lever	2.94 ^{+0.49} / _{-0.1} MPa {30 ⁺⁵ / ₋₁ kg/cm ² }
	2	Malfunction of control valve (spool)	The control valve spool may have a malfunction. Check it directly.	

H-11 Work equipment hydraulic drift is large**1) Boom hydraulic drift is large**

Failure information	• Boom hydraulic drift is large.
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective boom cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Boom cylinder	Leakage from cylinder
			Relieve by raising boom	10 cc/min
	2	Defective seal of boom control valve (lock valve) (PC35MR-3)	The lock valve of the boom control valve may be defective seal. Check it directly.	
	3	Defective seal of boom control valve (spool)	The boom control valve spool may have a defective seal. Check it directly.	
	4	Defective seal of boom control valve (suction valve) (PC27, 30MR-3)	The suction valve (bottom side) of the boom control valve may have a defective seal. Check it directly.	

2) Arm hydraulic drift is large

Failure information	• Arm hydraulic drift is large.
Relative information	• When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective arm cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Arm cylinder	Leakage from cylinder
			Relieved in arm-IN operation	10 cc/min
	2	Defective seal of arm control valve (spool)	The arm control valve spool may have a defective seal. Check it directly.	
	3	Defective seal of arm control valve (suction valve)	The suction valve (bottom side) of the arm control valve may have a defective seal. Check it directly.	

3) Bucket hydraulic drift is large

Failure information	<ul style="list-style-type: none"> Bucket hydraulic drift is large.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective bucket cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Bucket cylinder	Leakage from cylinder
			Relieved in bucket-CURL operation	10 cc/min
	2	Defective seal of bucket control valve (spool)	The bucket control valve spool may have a defective seal. Check it directly.	
	3	Defective seal of bucket control valve (suction valve)	The suction valve (bottom side) of the bucket control valve may have a defective seal. Check it directly.	

H-12 Time lag of work equipment is large

Failure information	<ul style="list-style-type: none"> Time lag of work equipment is large.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Malfunction of control valve (suction valve)	
			The suction valve (head side) of the control valve may have a malfunction. Check it directly.

H-13 In compound operation of work equipment, speed of part loaded more is low

Failure information	<ul style="list-style-type: none"> In compound operation of work equipment, speed of part loaded more is low.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Malfunction of pressure compensation valve on less load side	The pressure compensation valve of the control valve on less load side may have a malfunction. Check it directly.		
			Combination of operations	More load side	Less load side
			Boom RAISE + Arm IN	Boom	Arm
			Boom RAISE + Arm OUT	Arm	Boom
			Boom RAISE + Bucket CURL	Boom	Bucket
			Arm OUT + Bucket CURL	Arm	Bucket
			Boom LOWER + Arm OUT	Arm	Boom

H-14 Machine deviates during travel

1) Machine deviates during ordinary travel

Failure information	<ul style="list-style-type: none"> Machine deviates during ordinary travel.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective undercarriage	<ul style="list-style-type: none">• Check that the track shoes on both sides are tensed evenly.• Check that the front idler, rollers, etc. are free of abnormal rotation, deformation, and damage.			
	2	Malfunction of travel PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Travel lever		PPC valve output pressure	
			Operate to drive forward or in reverse		$2.94^{+0.49}_{-0.1}$ MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
			Output difference between above both sides		Max. 0.4 MPa {4 kg/cm ² }	
	3	Defective adjustment of travel deviation adjustment orifice of pump (PC35MR-3)	Adjust the travel deviation adjustment orifice of the pump. ★ See Testing and adjusting, "Testing and adjusting travel deviation".			
	4	Malfunction of unload valve ★ PC35MR-3 has 2 sets of this valve.	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Control levers		Machine model	Unload pressure
			Set all levers in neutral	PC27, 30MR-3		$3.9^{+0.98}_0$ MPa {39.6 ⁺¹⁰ ₀ kg/cm ² }
				PC35MR-3		$3.2^{+0.98}_0$ MPa {33 ⁺¹⁰ ₀ kg/cm ² }
	5	Malfunction of logic valve (PC35MR-3)	The logic valve may have a malfunction. Check it directly.			
	6	Malfunction of pump merge-divider valve (PC35MR-3)	The pump merge-divider valve may have a malfunction. Check it directly.			
	7	Malfunction of travel control valve (spool)	The travel control valve spool may have a function. Check it directly.			
8	Malfunction of travel control valve (pressure compensation valve)	The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.				
9	Defective travel junction variable throttle	The travel junction variable throttle may have a malfunction. Check it directly.				
10	Defective center swivel joint	Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction changes at this time, the center swivel joint is defective.				
11	Defective travel motor	Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction does not change at this time, the travel motor is defective.				
12	Defective final drive	The final drive may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)				

2) Machine deviates when it starts (It does not deviate during ordinary travel)

Failure information	<ul style="list-style-type: none"> Machine deviates when it starts (It does not deviate during ordinary travel).
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of travel motor counterbalance valve	The travel motor counterbalance valve may have a malfunction. Check it directly.	
	2	Malfunction of travel PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Travel lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to drive forward or in reverse	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	3	Defective travel motor holding brake	If the results of 1 and 2 above are normal, release of the travel motor holding brake may be delayed. Check the parking brake directly.	

H-15 Travel speed or travel power is low (while work equipment is normal)

Failure information	<ul style="list-style-type: none"> Travel speed or travel power is low (while work equipment is normal).
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the machine does not deviate during travel.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Defective undercarriage	<ul style="list-style-type: none">• Check that the track shoes on both sides are tensed evenly.• Check that the front idler, rollers, etc. are free of abnormal rotation, deformation, and damage.			
	2	Malfunction of travel PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Travel lever		PPC valve output pressure	
			Operate to drive forward or in reverse		2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
			Output difference between above both sides		Max. 0.4 MPa {4 kg/cm ² }	
	3	Malfunction of unload valve ★ PC35MR-3 has 2 sets of this valve.	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Control levers		Machine model	Unload pressure
			Set all levers in neutral	PC27, 30MR-3		3.9 ^{+0.98} ₀ MPa {39.6 ⁺¹⁰ ₀ kg/cm ² }
				PC35MR-3		3.2 ^{+0.98} ₀ MPa {33 ⁺¹⁰ ₀ kg/cm ² }
	4	Malfunction of logic valve (PC35MR-3)	The logic valve may have a malfunction. Check it directly.			
	5	Malfunction of pump merge-divider valve (PC35MR-3)	The pump merge-divider valve may have a malfunction. Check it directly.			
	6	Malfunction of travel control valve (spool)	The travel control valve spool may have a function. Check it directly.			
	7	Malfunction of travel control valve (pressure compensation valve)	The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.			
	8	Defective adjustment or malfunction of main relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
Lever to be operated			Main relief pressure			
Travel lever operated to relieve			PC27MR-3		24.5 ^{+0.98} _{-0.49} MPa {250 ⁺¹⁰ ₋₅ kg/cm ² }	
			PC30, 35MR-3		26.0 ^{+0.98} _{-0.49} MPa {265 ⁺¹⁰ ₋₅ kg/cm ² }	

H-16 Machine is not steered well or steering power is low

Failure information	<ul style="list-style-type: none"> Machine is not steered well or steering power is low.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of travel PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Travel lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate one side	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of logic valve (PC35MR-3)	The logic valve may have a malfunction. Check it directly.	
	3	Malfunction of travel junction variable throttle valve	The travel junction variable throttle valve may have a malfunction. Check it directly.	
	4	Malfunction of pump merge-divider valve (PC35MR-3)	The pump merge-divider valve may have a malfunction. Check it directly.	
	5	Malfunction of travel control valve (spool)	The travel control valve spool may have a function. Check it directly.	
	6	Malfunction of travel control valve (pressure compensation valve)	The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.	
	7	Malfunction of travel control valve (suction valve) (PC35MR-3)	The suction valve of the travel control valve may have a malfunction. Check it directly.	
	8	Defective center swivel joint seal	The center swivel joint seal may be defective. Check it directly.	

H-17 Travel speed does not change

Failure information	<ul style="list-style-type: none"> Travel speed does not change or it is low or high.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the electric system is normal. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of travel speed shifting solenoid valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			2nd travel speed selection switch	Solenoid valve output pressure
			OFF (Monitor lamp goes OFF)	0 MPa {0 kg/cm ² }
			ON (Monitor lamp lights up)	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of travel motor (speed shifting section)	If the oil pressure in 1 above is normal, the speed shifting section of the travel motor may have a malfunction.	

H-18 Travel motor does not work

1) Travel motors on both sides do not work (PC35MR-3)

Failure information	<ul style="list-style-type: none"> Travel motors on both sides do not work (PC35MR-3).
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting
	1	Defective PPC circuit check valve (for pump merge-divider valve drive pressure)	
			If the PPC circuit pressure of only one of the left travel (forward and reverse) and right travel (forward and reverse) systems is normal, the PPC circuit check valve of that system may have a malfunction. Check it directly.

[Remarks]

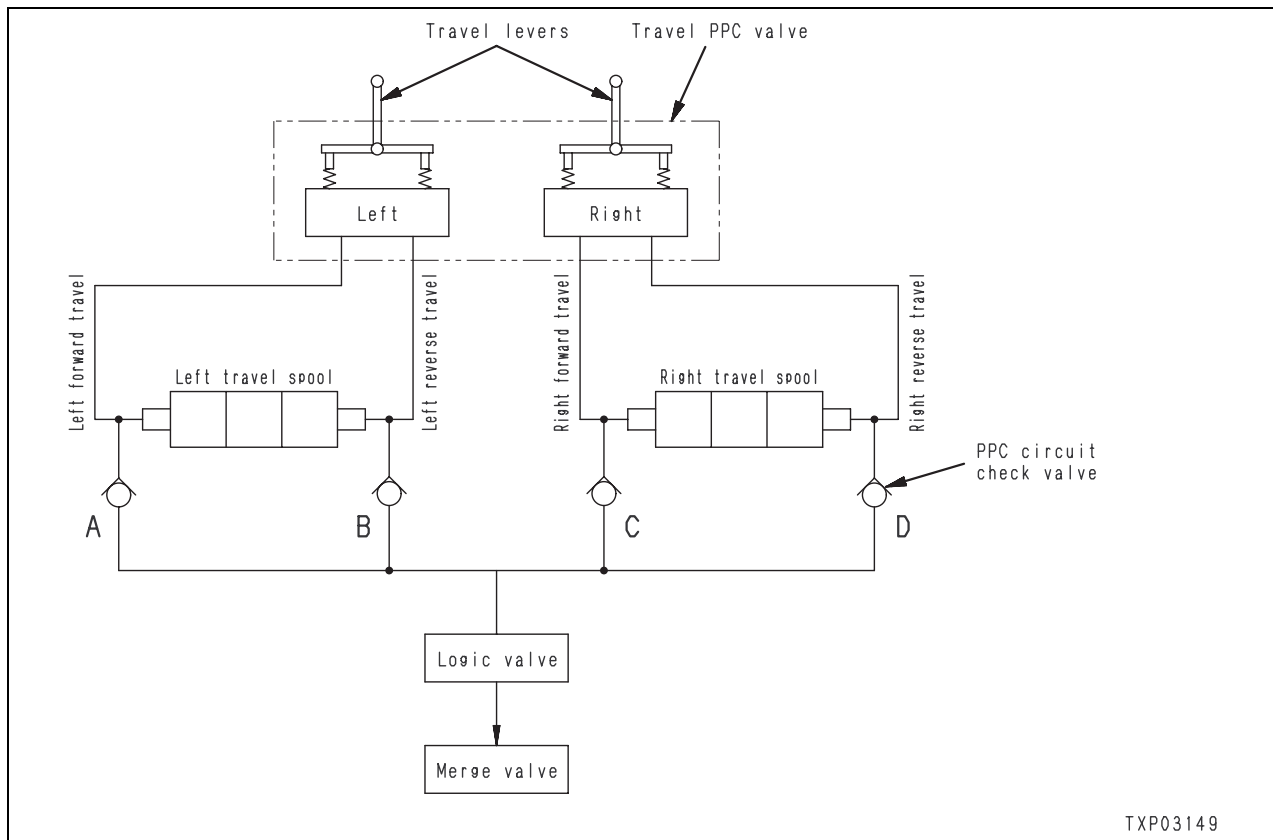
Relationship between defect of PPC circuit check valve and “Travel motor does not work”

PPC circuit check valves (A) – (D) are installed as shown in the following figure to take out the signal pressure for changing the pump merge valve from the travel PPC pressure.

If the checking function of check valves (A) – (D) is lost, the travel motors may not work.

Example: When checking function of (A) is lost

- Operation in which travel motors work normally: “Left forward”, “Left forward + Right forward”, “Left forward + Right reverse”
- Operation in which travel motors may not work normally: “Left reverse”, “Right forward”, “Right reverse”, “Left reverse + Right forward”, “Left reverse + Right reverse”



2) Travel motor on only one side does not work

Failure information	<ul style="list-style-type: none"> Travel motor on only one side does not work.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective seal of travel control valve (suction valve) (PC35MR-3)	The seal of the suction valve of the travel control valve may have a malfunction. Check it directly.	
	2	Malfunction of travel motor (counterbalance valve)	The counterbalance valve of the travel motor may have a malfunction. Check it directly.	
	3	Defective travel motor	Replace the hoses between the center swivel joint and travel motor on both sides. If the deviating direction does not change at this time, the travel motor is defective.	
	4	Defective final drive	The final drive may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)	
	5	Malfunction of travel PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Travel lever	Travel PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate for forward or reverse travel	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	6	Malfunction of travel control valve spool	The travel control valve spool may have a malfunction. Check it directly.	

H-19 Speed or power of swing is low**1) Speed or power of swing is low in both directions**

Failure information	<ul style="list-style-type: none"> Speed or power of swing is low in both directions.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment or malfunction of swing motor safety valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever		Swing relief pressure
			Relieve by swinging (in both directions respectively).	PC27MR-3	18.1 ± 0.98 MPa {185 ± 10 kg/cm ² }
				PC30, 35MR-3	19.6 ± 0.98 MPa {200 ± 10 kg/cm ² }
	2	Malfunction of swing motor holding brake	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing motor holding brake release pressure
			Operate to move arm IN or swing to right or left		2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.		
	3	Defective swing machinery	The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)		
	4	Malfunction of swing control valve spool	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing PPC circuit pressure
			Operate to swing to right or left		2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.		
	5	Internal defect of swing motor	If the results of 1 – 4 above are normal, the swing motor may have a defect in it. Check it directly.		

2) Speed or power of swing is low in only one direction

Failure information	<ul style="list-style-type: none"> Speed or power of swing is low in only one direction.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	Swing relief pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to swing to right or left	$2.94^{+0.49}_{-0.1}$ MPa { 30^{+5}_{-1} kg/cm ² }
	2	Malfunction of swing control valve spool	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	Swing PPC circuit pressure
			Operate to swing to right or left	$2.94^{+0.49}_{-0.1}$ MPa { 30^{+5}_{-1} kg/cm ² }
			If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.	
	3	Defective seal of swing motor suction valve or check valve	The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.	

H-20 Machine does not swing**1) Machine does not swing in either direction**

Failure information	<ul style="list-style-type: none"> Machine does not swing in either direction.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-3, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment or malfunction of swing motor safety valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever		Swing relief pressure
			Relieve by swinging (in both directions respectively).	PC27MR-3	18.1 ± 0.98 MPa {185 ± 10 kg/cm ² }
				PC30, 35MR-3	19.6 ± 0.98 MPa {200 ± 10 kg/cm ² }
	2	Malfunction of swing motor holding brake	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing motor holding brake release pressure
			Operate to move arm IN or swing to right or left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
			If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.		
	3	Defective swing machinery	The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)		
	4	Malfunction of swing control valve spool	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing PPC circuit pressure
			Operate to swing to right or left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
			If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.		
	5	Malfunction of check valve in swing holding brake release pressure pickup circuit	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing motor holding brake release pressure
			Operated to move arm IN or swing to right and left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
If oil pressure in any hydraulic circuit is defective, the check valves of the right and left swing PPC circuits and arm IN PPC circuit may have a malfunction. Check those valves directly.					
6	Internal defect of swing motor	If the results of 1 – 5 above are normal, the swing motor may have a defect in it. Check it directly.			

2) Machine does not swing in only one direction

Failure information	<ul style="list-style-type: none"> Machine does not swing in only one direction.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-3, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to swing to right or left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of swing control valve spool	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	Swing PPC circuit pressure
			Operate to swing to right or left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.	
	3	Defective seal of swing motor suction valve or check valve	The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.	
	4	Malfunction of load check valve in control valve spool	Since the load check valve in the control valve spool may have a malfunction, check it directly.	
	5	Malfunction of check valve in swing holding brake release pressure pickup circuit	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	Swing motor holding brake release pressure
			Operated to move arm IN or swing to right and left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If oil pressure in any hydraulic circuit is defective, the check valves of the right and left swing PPC circuits and arm IN PPC circuit may have a malfunction. Check those valves directly.	

H-21 Swing acceleration performance is low**1) Swing acceleration performance is low in both directions**

Failure information	<ul style="list-style-type: none"> Swing acceleration performance is low in both directions.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment or malfunction of swing motor safety valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Control lever	Swing relief pressure	
			Relieve by swinging (in both directions respectively).	PC27MR-3	18.1 ± 0.98 MPa {185 ± 10 kg/cm ² }
				PC30, 35MR-3	19.6 ± 0.98 MPa {200 ± 10 kg/cm ² }
	2	Malfunction of swing motor holding brake	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever	Swing motor holding brake release pressure	
			Operate to move arm IN or swing to right or left	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
			If the above hydraulic pressure is normal, the brake may have a malfunction. Check it directly.		
	3	Defective swing machinery	The swing machinery may have a defect in it. Check it directly. (Its condition can be checked by abnormal sound, abnormal heat, metal chips in drain oil, etc.)		
4	Internal defect of swing motor	If the results of 1 – 3 above are normal, the swing motor may have a defect in it. Check it directly.			

2) Swing acceleration performance is low in only one direction

Failure information	<ul style="list-style-type: none"> Swing acceleration performance is low in only one direction.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the blade operates normally. (If the blade speed is also low, carry out troubleshooting H-1, 3) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to swing to right or left	$2.94^{+0.49}_{-0.1}$ MPa { 30^{+5}_{-1} kg/cm ² }
	2	Malfunction of swing control valve spool	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left control lever	Swing PPC circuit pressure
			Operate to swing to right or left	$2.94^{+0.49}_{-0.1}$ MPa { 30^{+5}_{-1} kg/cm ² }
			If the above hydraulic pressure is normal, the swing control valve spool may have a malfunction. Check it directly.	
	3	Defective seal of swing motor suction valve or check valve	The seal of the suction valve or check valve of the swing motor may be defective. Check it directly.	
	4	Malfunction of load check valve in control valve spool	Since the load check valve in the control valve spool may have a malfunction, check it directly.	

H-22 Machine overruns when it stops swinging**1) Machine overruns when it stops swinging in both directions**

Failure information	<ul style="list-style-type: none"> Machine overruns when it stops swinging in both directions.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting		
	1	Defective adjustment of swing motor safety valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.		
			Left control lever		Swing relief pressure
			Relieve by swinging (in both directions respectively).	PC27MR-3	18.1 ± 0.98 MPa {185 ± 10 kg/cm ² }
				PC30, 35MR-3	19.6 ± 0.98 MPa {200 ± 10 kg/cm ² }
	2	Defective swing motor	If the result of 1 above is normal, the swing motor may have a defect in it. Check it directly.		

2) Machine overruns when it stops swinging in only one direction

Failure information	<ul style="list-style-type: none"> Machine overruns when it stops swinging in only one direction.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting			
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Left control lever		PPC valve output pressure	
			Set in neutral		0 MPa {0 kg/cm ² }	
			Operate to swing to right or left		2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }	
	2	Malfunction of swing control valve (spool)	The swing control valve spool may have a malfunction. Check it directly.			
	3	Defective adjustment or malfunction of swing motor (safety valve)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.			
			Swing lock switch	Left control lever	Swing relief pressure	
			ON	Operate to relieve by swinging (in both directions respectively)	PC27MR-3	18.1 ± 0.98 MPa {185 ± 10 kg/cm ² }
					PC30MR-3 PC35MR-3	19.6 ± 0.98 MPa {200 ± 10 kg/cm ² }
4	Defective seal of swing motor (suction valve)	The seal of the suction valve of the swing motor may be defective. Check it directly.				

H-23 Large shock is made when machine stops swinging

Failure information	<ul style="list-style-type: none"> Large shock is made when machine stops swinging.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, set the hydraulic oil temperature to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of swing PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operated to swing machine	2.94 ^{+0.49} / _{-0.1} MPa {30 ⁺⁵ / ₋₁ kg/cm ² }
	2	Malfunction of swing motor safety valve	Since the swing motor safety valve may have a malfunction, check it directly.	
	3	Malfunction of control valve spool	Since the control valve spool may have a malfunction, check it directly.	

H-24 When upper structure stops swinging, it makes large sound

Failure information	<ul style="list-style-type: none"> When upper structure stops swinging, it makes large sound.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of back pressure check valve	The back pressure check valve may have a malfunction. Check it directly.	
	2	Malfunction of swing motor (safety valve)	The swing motor (safety valves) may have a malfunction. Check the valves directly.	
	3	Malfunction of swing motor (suction valve)	The swing motor (suction valves) may have a malfunction. Check the valves directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)	
	4	Defective swing machinery	The swing machinery may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)	

H-25 Hydraulic drift of swing is large**1) Hydraulic drift of swing is large (while swing holding brake is applied)**

Failure information	<ul style="list-style-type: none"> Hydraulic drift of swing is large (when swing holding brake is applied).
Relative information	<ul style="list-style-type: none"> When the control levers on the swing and arm IN side are in neutral, the swing holding brake operates and the upper structure is fixed by the disc brake.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction or internal defect of swing motor (holding brake section)	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Control lever	Swing motor holding brake release pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to swing	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
			If the above hydraulic pressure is normal, the holding brake section of the swing motor may have a malfunction or a defect in it. Check it directly.	

2) Hydraulic drift of swing is large (while swing holding brake is released)

Failure information	<ul style="list-style-type: none"> Hydraulic drift of swing is large (while swing holding brake is released).
Relative information	<ul style="list-style-type: none"> If the arm is moved IN, the swing brake is released and the upper structure is held by only hydraulic pressure.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective seal of swing control valve (spool)	The seal of the swing control valve spool may be defective. Check it directly.	
	2	Defective seal of swing motor (safety valve)	The safety valve of the swing motor may have a malfunction. Check it directly.	
	3	Defective seal of swing motor (suction valve)	The suction valve of the swing motor may have a malfunction. Check it directly. (Replace the suction valves on both sides and judge the faulty part by the change of the phenomenon.)	

H-26 Speed or power of blade is low

Failure information	<ul style="list-style-type: none"> Speed or power of blade is low.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the swing operation is normal. (If the swing speed is also low, carry out troubleshooting H-1, 3) first. If the travel speed is also low, carry out troubleshooting H-1, 5) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective adjustment of gear pump relief valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade control lever	Gear pump relief pressure
			Operate to lower blade	PC27MR-3 20.6 ± 0.98 MPa {210 ± 10 kg/cm ² }
				PC30, 35MR-3 21.6 ^{+0.98} _{-0.49} MPa {220 ⁺¹⁰ ₋₅ kg/cm ² }
			If the oil pressure does not become normal after adjustment, the relief valve may have a malfunction or a defect in it. Check it directly.	
	2	Malfunction of PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to raise or lower blade	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	3	Malfunction of blade control valve spool	The blade control valve spool may have a malfunction. Check it directly.	
	4	Defective blade cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade cylinder	Leakage from cylinder
			Relieve by lowering blade	10 cc/min
	5	Malfunction of load check valve in control valve spool	The load check valve in the control valve spool may have a malfunction. Check it directly.	
	6	Malfunction of suction valve of control valve	The suction valve of the control valve may have a malfunction. Check it directly.	
			★ The suction valve is installed on the LOWER side of PC27, 30MR-3 and on both sides of PC35MR-3.	

H-27 Blade does not move

Failure information	<ul style="list-style-type: none"> Blade does not move.
Relative information	<ul style="list-style-type: none"> Before starting troubleshooting, check that the oil level in the hydraulic tank is proper. When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C. Check that the swing operation is normal. (If the machine does not swing, carry out troubleshooting H-3, 3) first. If the machine does not travel, carry out troubleshooting H-3, 5) first.)

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Malfunction of PPC valve	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade control lever	PPC valve output pressure
			Set in neutral	0 MPa {0 kg/cm ² }
			Operate to raise and lower blade	2.94 ^{+0.49} _{-0.1} MPa {30 ⁺⁵ ₋₁ kg/cm ² }
	2	Malfunction of blade control valve spool	The blade control valve spool may have a malfunction. Check it directly.	
	3	Defective blade cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade cylinder	Leakage from cylinder
			Relieve by lowering blade	10 cc/min
	4	Deformation of blade cylinder or blade	The blade cylinder or blade is deformed. Check them directly.	

H-28 Hydraulic drift of blade is large

Failure information	<ul style="list-style-type: none"> Hydraulic drift of blade is large.
Relative information	<ul style="list-style-type: none"> When starting troubleshooting, warm up the hydraulic oil to 45 – 55°C.

Presumed cause and standard value in normalcy	Causes		Standard value in normalcy and references for troubleshooting	
	1	Defective blade cylinder	★ Prepare with engine stopped, then run engine at full throttle and carry out troubleshooting.	
			Blade cylinder	Leakage from cylinder
			Relieve by lowering	10 cc/min
	2	Defective seal of blade control valve (spool)	The seal of blade control valve spool may be defective. Check it directly.	
	3	Defective seal of blade control valve (suction valve)	The seal of the suction valve (bottom side) of the blade control valve may be defective. Check it directly. ★ The suction valve is installed on the bottom side of PC27, 30MR-3 and on both sides of PC35MR-3.	

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model Serial number

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

40 Troubleshooting

400 Troubleshooting of engine (S-mode)

Method of using troubleshooting charts	3
S-1 Starting performance is poor	6
S-2 Engine does not start	7
S-3 Engine does not pick up smoothly	10
S-4 Engine stops during operations	11
S-5 Engine does not rotate smoothly	12
S-6 Engine lacks output (or lacks power)	13
S-7 Exhaust smoke is black (incomplete combustion)	14
S-8 Oil consumption is excessive (or exhaust smoke is blue)	15
S-9 Oil becomes contaminated quickly	16
S-10 Fuel consumption is excessive	17
S-11 Oil is in coolant (or coolant spurts back or coolant level goes down)	18
S-12 Oil pressure drops	19
S-13 Oil level rises (Entry of coolant/fuel)	20
S-14 Coolant temperature becomes too high (overheating)	21
S-15 Abnormal noise is made	22
S-16 Vibration is excessive	23

Method of using troubleshooting charts

The troubleshooting chart consists of the “questions”, “check items”, “causes”, and “troubleshooting” blocks.

The questions and check items are used to pinpoint high probability causes by simple inspection or from phenomena without using troubleshooting tools.

Next, troubleshooting tools or direct inspection are applied to check the narrowed causes in order from the most probable one to make final confirmation according to the troubleshooting procedure.

Questions

Items to be drawn from the user or operator.

They correspond to **A** and **B** in the chart on the right.

The items in **A** are basic ones.

The items in **B** can be drawn from the user or operator, depending on their level.

Check items

Items to be simply checked by the serviceman to narrow down causes.

They correspond to **C** in the chart on the right.

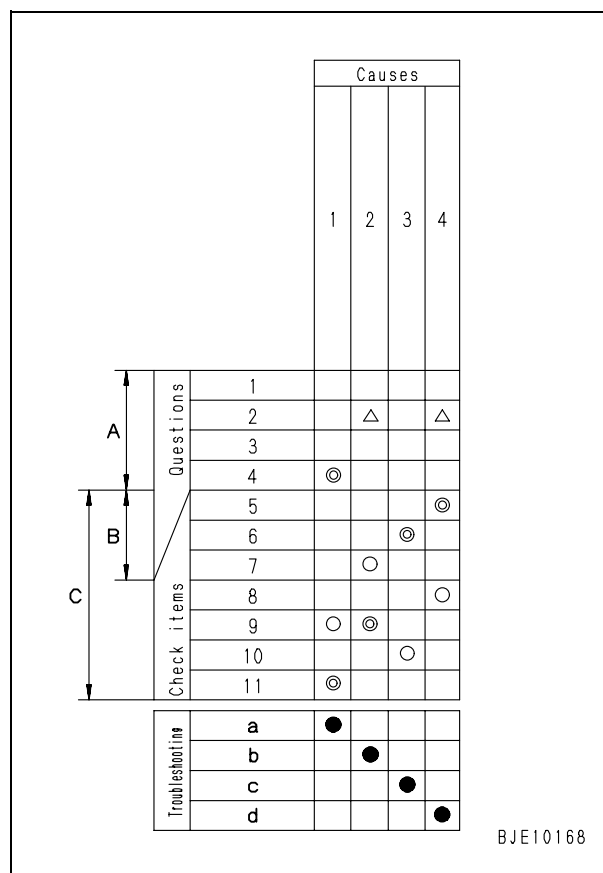
Causes

Items to be narrowed from the questions and check items.

The serviceman narrows down the probable causes from **A**, **B**, and **C**.

Troubleshooting

Items to finally verify whether the narrowed down causes are undoubtedly the real causes using the troubleshooting tools and direct inspections.



Items listed in the [Questions] and [Check items] and related to the [Causes] are marked with △, ○, or ◎.

△ : Causes to be referred to for questions and check items

○ : Causes related to questions and check items

◎ : Causes highly probable among ones marked with ○

- ★ When narrowing the “causes”, apply the items marked with ◎ before those marked with ○. When narrowing the causes, do not apply the items marked with △. (If no items have other marks and the causes cannot be narrowed, however, you may apply them.)

<Example of troubleshooting> Exhaust gas is black

Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. 3 symptoms have causal relationship with this problem: [Color of exhaust gas gradually became black], [Power was lost gradually], and [Air cleaner clogging caution lamp is flashing].

S-7 Exhaust smoke is black (incomplete combustion)

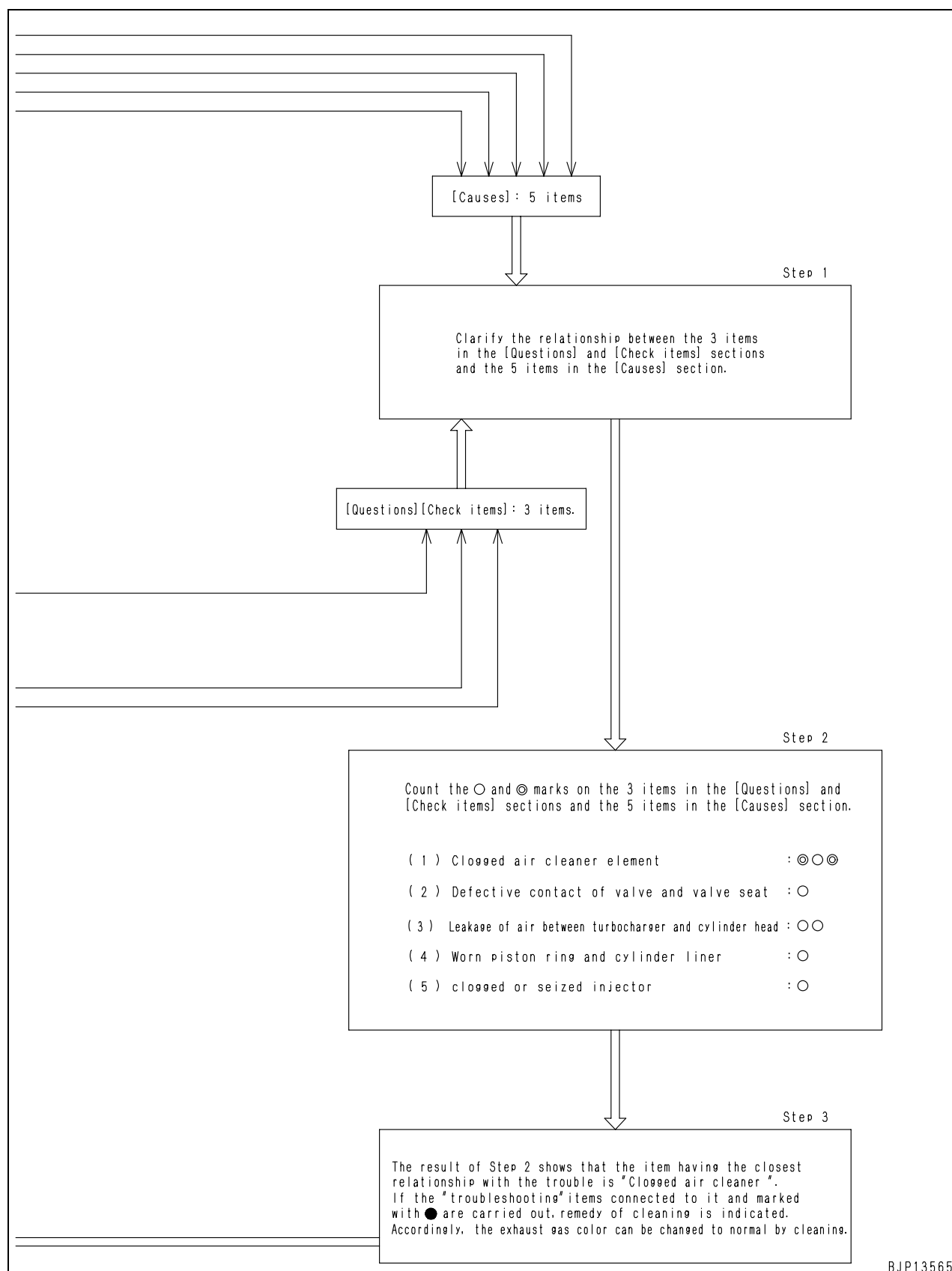
General causes why exhaust smoke is black

- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There is overheating
→ See S-14 Coolant temperature becomes too high (Overheating)*
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

		Causes													
		Clogged air cleaner element	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormally worn injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness	
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△				△	△						
	Color of exhaust gas	Suddenly became black	◎			◎			○	○	○				
		Gradually became black	◎			○				○	○				
		Blue under light load							◎						
	Non-specified fuel is being used								○	○					
	Oil must be added more frequently							◎							
	Power was lost	Suddenly	○	◎	○	○	○	○	○	○					
		Gradually													
	Dust indicator is red	◎													
Check items	Muffler is crushed					◎									
	Air leaks between turbocharger and cylinder head, clamp is loosend					◎									
	Engine is operated in low-temperature mode at normal temperature											○	○	○	
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low								○	◎					
	When engine is cranked, interference sound is generated around turbocharger		◎												
	When engine is cranked, abnormal sound is generated around cylinder head			◎											
	Pump relief speed is high (Fuel is injected excessively)										○				
	Exhaust noise is abnormal		○			◎			○						
	Engine dose not pick up smoothly and combustion is irregular		○		○	○		○	◎						
	Blow-by gas is excessive						◎								
Troubleshooting	If spill hose from injector is disconnected, abnormally much fuel spills									◎					
	Inspect air cleaner directly	●													
	When turbocharger is rotated by hand, it is found to be heavy		●												
	When compression pressure is measured, it is found to be low			●				●							
	Inspect valve clearance directly				●										
	When muffler is removed, exhaust sound improves					●									
	Carry out troubleshooting according to 'Rail Press (Very) Low Error (#1)' indicated by code								●		●				
	When a cylinder is cut out for reduced cylinder mode operation, engine speed dose not change									●					
	Carry out troubleshooting according to 'Coolant temp Sens High (Low) Error (#2)' indicated by code											●	●	●	
	Check with monitoring function														
Remedy		Clean	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Adjust	Replace	Replace	

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If we look from these 3 symptoms to find the causes, we find that there is a relationship with 5 causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.



S-1 Starting performance is poor

General causes why starting performance is poor

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

		Causes											
		Clogged air cleaner element	Defective contact of valve, valve seat	Worn piston ring, cylinder	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter, element	Defective fuel injection pump (Stuck rack or plunger)	Defective fuel injection nozzle	Defective intake air heater system	Defective alternator (regulator section)	Defective alternator (generator section)	Defective, deteriorated battery
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period	△				△						△
	Starting performance	Became worse gradually	○	○	○		○						
		Engine starts easily when warm							○				○
	Non-specified fuel is being used						○	○	○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		○				○	○	○				
	Engine oil must be added more frequently			○									
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally								○				
	During operation, charge level monitor indicates abnormal charge									○	○		
	Dust indicator is red		○										
	Air breather hole of fuel tank cap is clogged				○								
	Fuel is leaking from fuel piping					○		○					
	Starting motor cranks engine slowly											○	
	When starting switch is turned ON and air bleeding plug of fuel filter is removed, fuel does not flow out						○						○
Check items	While engine is cranked with starting motor	When fuel injection pipe sleeve nut is loosened, fuel does not flow out						○					
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low								○				
	Engine does not pick up smoothly and combustion is irregular			○	○				○				
	There is hunting from engine (rotation is irregular)				○	○	○						
	Blow-by gas is excessive			○									

Troubleshooting	Inspect air cleaner directly		●														Carry out troubleshooting in E-mode
	When compression pressure is measured, it is found to be low			●	●												
	When air is bled from fuel system, air comes out						●										
	Inspect fuel filter, strainer directly							●									
	Control rack is heavy to push or does not return								●								
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●							
	When starting switch is turned to HEAT, intake air heater mount does not become warm										●						
	Is voltage 10 – 15 V between alternator terminal L and terminal E with engine at low idle?	Yes											●				
		No													●		
When specific gravity of electrolyte and voltage of battery are measured, they are low																●	
		Remedy	Clean	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Replace	Replace	Replace	Replace	—	

Carry out troubleshooting in E-mode

S-2 Engine does not start

a) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
→ See "S-4 Engine stops during operations".
- Defective electrical system (Starting circuit)

a) Engine does not turn			Causes							
			Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective safety relay	Defective starting motor (motor section)	Defective starting circuit wiring
General causes why engine does not turn										
● Internal parts of engine seized → See “S-4 Engine stops during operations”.										
● Defective electrical system (Starting circuit)										

Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△						
Check items	Condition of horn when starting switch is turned ON	Horn does not sound		○		○				○
		Horn volume is low		○						
	Battery electrolyte is low			○						
	Battery terminal is loose				○					
	When starting switch is turned ON, there is no operating sound from battery relay			○		○				
	When starting switch is turned to START, starting pinion does not move out			○			○			○
	When starting switch is turned to START, starting pinion moves out, but	Speed of rotation is low		○						
		Makes grating noise		○					○	
		Soon disengages again						○		
		Makes rattling noise and does not turn		○				○	○	

Troubleshooting	Inspect flywheel ring gear directly		●							Carry out troubleshooting in E-mode
	When specific gravity of electrolyte and voltage of battery are measured, they are low			●						
	Turn starting switch OFF, connect cord, and carry out troubleshooting at ON	There is not voltage (10 – 15 V) between battery relay terminal B and terminal E				●				
		When terminal B and terminal C of starting switch are connected, engine starts					●			
		When terminal B and terminal C at safety relay outlet are connected, engine starts						●		
		Even if terminal B and terminal C at safety relay outlet are connected, engine does not start							●	
		When safety switch terminal and terminal B of starting motor are connected, engine starts							●	
Remedy		Replace	Replace	Correct	Replace	Replace	Replace	Replace	—	

General causes why engine turns but no exhaust smoke comes out

- Fuel is not being supplied
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

Troubleshooting	Directly checked fuel tank cap is clogged				●							Carry out troubleshooting in E-mode
	When air is bled from fuel system, air comes out					●						
	Inspect fuel filter directly						●					
	Inspect feed pump directly							●				
	Control rack is heavy to push or does not return								●	●		
	Water and dust collected in water separator										●	
		Remedy	Replace	Add	Correct	Correct	Replace	Replace	Replace	Replace	Clean	
			—									Carry out troubleshooting in E-mode
			—									Carry out troubleshooting in E-mode

**c) Exhaust smoke comes out but engine does not start
(fuel is being injected)**

General causes why exhaust smoke comes out but engine does not start

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

c) Exhaust smoke comes out but engine does not start (fuel is being injected)		Causes													
		Clogged air cleaner element	Worn dynamic valve system (Valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Use of improper fuel	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel system, entry of air	Clogged fuel filter	Defective fuel injection pump (Stuck rack or plunger)	Clogged fuel injection nozzle or defective spray	Defective, deteriorated battery	Clogged water separator	Defective intake air heater system	Defective fuel pump	
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period			△				△		△		△		
	Suddenly failed to start			○					○						
	Non-specified fuel is being used								○	○					
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		○						○			○			
	Engine oil must be added more frequently				○										
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally												○		
	Dust indicator is red		○												
	Air breather hole of fuel tank cap is clogged						○								
	Rust and water are found when fuel tank is drained								○			○			
	When fuel filter is removed, there is not fuel in it					○									
	Fuel is leaking from fuel piping							○							
	When priming pump is operated, it marks no reaction or it is heavy							○	○						
	Starting motor cranks engine slowly										○				
Check items	When engine is cranked, abnormal sound is generated around cylinder head		○												
	When fuel control lever is set to full position, it does not contact stopper								○						
	When starting switch is turned ON and air bleeding plug of fuel filter is removed, fuel does not flow out				○			○						○	
	While engine is cranked with starting motor,	When fuel injection pipe sleeve nut is loosened, fuel does not flow out							○						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									○					

Troubleshooting	Inspect air cleaner directly	●													Carry out troubleshooting in E-mode
	Inspect dynamic valve system directly		●												
	When compression pressure is measured, it is found to be low			●											
	Directly checked fuel tank cap is clogged					●									
	When air is bled from fuel system, air comes out						●								
	Inspect fuel filter directly							●							
	Control rack is heavy to push or does not return								●						
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●					
	When specific gravity of electrolyte and voltage of battery are measured, they are low										●				
	Water and dust collected in water separator											●			
	When starting switch is turned to HEAT, intake air heater mount does not become warm												●		

	Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Clean	Replace	—
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S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Defective condition of fuel spray
- Improper selection of fuel

		Causes										
		Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Seized turbocharger, interference of turbocharger	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Clogged water separator	Clogged fuel injection nozzle or defective spray	Seized fuel injection pump plunger
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△		△			△	△		
	Engine pick-up suddenly became worse				○		○	○				○
	Non-specified fuel is being used								○	○	○	○
	Replacement of filters has not been carried out according to Operation and Maintenance Manual	○							○	○		
	Oil must be added more frequently					○						
	Dust indicator is red	○										
	Air breather hole of fuel tank cap is clogged						○					
	Rust and water are found when fuel tank is drained							○	○			
	Fuel is leaking from fuel piping							○				
Check items	When starting switch is turned ON and air bleeding plug of fuel filter is loosened, fuel does not flow out							○	○			
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	○
	Color of exhaust gas					○					○	
	Blue under light load					○					○	
	Black	○	○		○							
	When engine is cranked, abnormal sound is generated around cylinder head			○								
	When engine is cranked, interference sound is generated around turbocharger				○							
	High idle speed under no load is normal, but speed suddenly drops when load is applied						○		○	○		
	There is hunting from engine (rotation is irregular)						○		○		○	
	Blow-by gas is excessive					○						
Troubleshooting	Inspect air cleaner directly	●										
	When compression pressure is measured, it is found to be low		●			●						
	Inspect valve clearance directly			●								
	When turbocharger is rotated by hand, it is found to be heavy				●							
	Directly checked fuel tank cap is clogged						●					
	When air is bled from fuel system, air comes out							●				
	Inspect fuel filter, strainer directly								●			
	Water and dust collected in water separator									●		
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●	
	Control rack is heavy to push or does not return											●
Remedy		Clean	Replace	Adjust	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Replace

S-4 Engine stops during operations

General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- There is overheating
- Defective hydraulic pump

General causes why engine stops during operations		Causes															
		Broken dynamic valve system (valve, rocker arm, etc.)	Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken, seized gear train	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogged fuel filter	Clogged water separator	Broken, seized feed pump	Broken fuel injection pump drive shaft	Stuck or seized fuel injection pump plunger	Broken auxiliary equipment (pump, etc.)	Problem in hydraulic pump	Defective fuel pump	
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period							△	△							
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	○	○	○	○					○	○	○	○	○		
		Engine overheated and stopped		○	○										○		
		Engine stopped slowly					○		○	○							
		There was hunting and engine stopped					○	○	○	○							
	Non-specified fuel is being used							○		○			○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual							○	○								
	Fuel level monitor indicates low level					○											
	When fuel tank is inspected, it is found to be empty					○											
Check items	Air breather hole of fuel tank cap is clogged						○										
	Fuel is leaking from fuel piping							○									
	When starting switch is turned ON and air bleeding plug of fuel filter is loosened, fuel does not flow out							○	○							○	
	Rust and water are found when fuel tank is drained								○								
	Metal particles are found when oil is drained	○	○	○						○							
	When engine is cranked by hand	Does not turn at all		○	○												
		Turns in opposite direction	○														
		Moves by amount of gear backlash				○									○		
		Fuel injection pump shaft does not turn											○				
	Engine turns, but stops when load is applied to machine														○		
Troubleshooting	Inspect dynamic valve system directly	●															
	Inspect piston, connecting rod directly		●														
	Inspect crankshaft bearing directly			●													
	Inspect gear train directly				●												
	Directly checked fuel tank cap is clogged							●									
	Inspect fuel filter, strainer directly								●								
	Directly checked feed pump gauze filter is clogged									●							
	Water and dust collected in water separator										●						
	Inspect feed pump directly																
	Control rack is heavy or does not return												●				
	Engine rotates when pump auxiliary equipment (pump, etc.) is removed														●		

S-5 Engine does not rotate smoothly

General causes why engine does not rotate smoothly

- Air in fuel system

General causes why engine does not rotate smoothly			Causes									
			Malfunction of governor	Defective adjustment of governor	Malfunction of control rack	Low idle speed set too low	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Clogged water separator	
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period							△	△		
	Condition of hunting	Occurs at a certain speed range	○	○	○							
		Occurs at low idle	○			○			○	○		
		Occurs even when speed is raised	○	○	○			○			○	
		Occurs on slopes					○					
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									○		
	When fuel tank is inspected, it is found to be empty						○					
	Air breather hole of fuel tank cap is clogged							○				
	Rust and water are found when fuel tank is drained									○	○	
	Fuel is leaking from fuel piping								○			
Check items	When starting switch is turned ON and air bleeding plug of fuel filter is loosened, fuel does not flow out								○	○		
	Engine speed sometimes rises too high		○	○								
	Engine sometimes does not stop soon		○		○							
Troubleshooting	When governor lever is moved it is found to be stiff		●		●							
	When injection pump is tested, governor is found to be improperly adjusted			●								
	When control rack is pushed, it is found to be heavy, or does not return				●							
	When fuel tank cap is inspected directly, it is found to be clogged					●						
	Directly checked fuel filter is clogged								●			
	Water and dust collected in water separator										●	
		Remedy	Replace	Adjust	Replace	Adjust	Add	Clean	Replace	Replace	Clean	

S-6 Engine lacks output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Defective spray condition of fuel
- Improper selection of fuel
- There is overheating
 - See "S-14 Coolant temperature becomes too high (Overheating)".

		Causes										
		Clogged air cleaner element	Air leakage from air intake piping	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Defective water separator	Leaking, clogged fuel piping	Clogged fuel filter	Stuck or seized fuel injection pump plunger	Clogged fuel injection nozzle or defective spray (Dirt caught in nozzle)
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△		△			△		△		
	Power was lost	Suddenly		○								
		Gradually	○		○			○		○		○
	Non-specified fuel is being used									○	○	○
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		○					○		○		
	Engine oil must be added more frequently				○	○						
	Dust indicator is red		○	○								
	Air breather hole of fuel tank cap is clogged						○					
	Fuel is leaking from fuel piping								○			
Check items	Fuel injection pump mounting bolts are loosened			○								○
	Color of exhaust gas	Black		○	○							
		Blue under light load				○						
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	○
	When engine is cranked, interference sound is generated around turbocharger											
	When engine is cranked, abnormal sound is generated around cylinder head				○							
	High idle speed is too low											
	High idle speed under no load is normal, but speed suddenly drops when load is applied						○	○		○	○	
	Engine does not pick up smoothly and combustion is irregular			○			○	○			○	
	There is hunting from engine (rotation is irregular)						○	○	○			
Blow-by gas is excessive					○							
Troubleshooting	Inspect air cleaner directly		●									
	Inspect air intake piping directly			●								
	When compression pressure is measured, it is found to be low				●	●						
	Inspect valve clearance directly				●							
	Directly checked fuel tank cap is clogged					●						
	Water and dust collected in water separator							●				
	Inspect fuel piping								●			
	Inspect fuel filter directly									●		
	Control rack is heavy to push or does not return										●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●
Remedy		Clean	Correct	Replace	Adjust	Replace	Clean	Clean	Correct	Replace	Replace	Correct
												Adjust

S-7 Exhaust smoke is black (incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There is overheating
→ See "S-14 Coolant temperature becomes too high (Overheating)".

		Causes								
		Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Crushed, clogged muffler	Worn piston ring, cylinder liner	Defective fuel injection pump (Too much fuel injection)	Clogged or seized fuel injection nozzle	Defective fuel injection pump (Seized rack or plunger)	Defective fuel injection timing
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△		△		△		
	Color of exhaust gas	Suddenly became black					○	○	○	
		Gradually became black	○					○		
		Blue under light load				○				
	Non-specified fuel is being used						○	○	○	
	Oil must be added more frequently					○				
	Power was lost	Suddenly			○		○	○	○	
		Gradually	○	○		○				
	Dust indicator is red		○							
Check items	Muffler is crushed				○					
	Fuel injection pump seal is removed									○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low						○	○		
	When engine is cranked, abnormal sound is generated around cylinder head				○					
	Exhaust noise is abnormal				○			○		
	Engine does not pick up smoothly and combustion is irregular				○	○	○	○	○	
	Blow-by gas is excessive					○				
Troubleshooting	Inspect air cleaner directly		●							
	When compression pressure is measured, it is found to be low			●		●				
	Inspect valve clearance directly				●					
	When muffler is removed, exhaust color improves				●					
	Tested fuel injection pump is disordered						●		●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●		
	Control rack is heavy to push or does not return								●	
	Fuel injection pump mounting bolts and nuts are loosened									●
Remedy		Clean	Replace	Adjust	Replace	Replace	Adjust	Replace	Replace	Adjust

S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive

- Abnormal consumption of oil
- Long-time operation of engine at low idle or high idle (Do not run engine at idle for more than 20 minutes continuously)
- External leakage of oil
- Wear of parts in lubrication system

		Causes									
		Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear oil seal	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△			△					
	Oil consumption suddenly increased				○						
	Oil must be added more frequently					○					
	Oil becomes contaminated quickly			○	○	○					
	Outside of engine is dirty with oil						○	○	○	○	
	There are loose piping clamps in intake system	○									
	There is oil in coolant										
	Oil level in damper chamber of applicable machine is high					○					
	Exhaust smoke is blue under light load				○	○					
Check items	Amount of blow-by gas	Excessive	○		○	○					
		None		○							
Troubleshooting	When intake manifold is removed, dust is found inside	●									
	When intake manifold is removed, inside is found to be dirty abnormally		●								
	Check breather and breather hose directly			●							
	When compression pressure is measured, it is found to be low				●	●					
	Inspect rear oil seal directly						●				
	There is external leakage of oil from engine						●	●	●	●	
Remedy		Correct	Replace	Clean	Replace	Replace	Correct	Correct	Correct	Correct	Correct

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Entry of exhaust gas into oil due to internal wear
- Clogging of lubrication passage
- Use of improper fuel
- Use of improper oil
- Operation under excessive load

		Causes					
		Worn valve, valve guide	Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Defective oil filter safety valve	Exhaust smoke is bad
Questions	Confirm recent repair history						
	Degree of use of machine	Operated for long period	△	△			
	Non-specified fuel is being used		○		○		
	Engine oil must be added more frequently		◎				
	Metal particles are found when oil is drained	○	○		◎		
	Inside of exhaust pipe is dirty with oil	◎					
Check items	Color of exhaust gas	Blue under light load		◎			
		Black					◎
	Amount of blow-by gas	Excessive	○	◎			
		None			○		
Troubleshooting	When compression pressure is measured, it is found to be low	●	●				See S-7
	Check breather and breather hose directly			●			
	Inspect oil filter directly				●		
	Spring of oil filter safety valve is hitched or broken					●	
Remedy		Replace	Replace	Clean	Replace	Replace	—

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive

- Leakage of fuel
- Defective condition of fuel injection (fuel pressure, injection timing)
- Excessive injection of fuel

		Causes							
		Fuel leakage inside head cover	Fuel leakage from fuel filter, piping, etc.	Defective feed pump oil seal	Defective fuel injection pump plunger	Defective fuel injection pump (Too much fuel injection)	Defective spray from fuel injection nozzle	Defective adjustment of fuel lever linkage	Improper fuel injection timing
Questions	Confirm recent repair history								
	Degree of use of machine	Operated for long period		△	△		△		
	Condition of fuel consumption	More than for other machines of same model				●		○	○
		Gradually increased			○		○		
		Suddenly increased	○	○					
Check items	There is external leakage of fuel from engine		○	○					
	Combustion is irregular			○			○		
	Engine oil level rises and oil smells of diesel fuel		○		○				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low				○		○		
	Low idle speed is high							○	
	Fuel injection pump seal is removed					○			
	Exhaust smoke color	Black				○	○		○
		White	○						
Troubleshooting	Remove and inspect head cover directly		●						
	Inspect feed pump oil seal directly			●					
	Control rack is heavy to push or does not return				●				
	Fuel injection rate of tested fuel injection pump is large					●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change						●		
	When engine speed is measured, low idle speed is found to be high							●	
Remedy		Correct	Correct	Replace	Replace	Adjust	Replace	Adjust	Adjust

S-11 Oil is in coolant (or coolant spurts back or coolant level goes down)

General causes why oil is in coolant

- Internal leakage in lubrication system
- Internal leakage in cooling system

		Causes		
		Broken cylinder head, head gasket	Internal cracks in cylinder block	Holes caused by pitting
Questions	Confirm recent repair history			
	Degree of use of machine	Operated for long period		△
	Oil level	Suddenly increased	○	
		Gradually increased		○
	Hard water is being used as coolant			○
Check items	Oil level has risen, oil is milky		○	○
	There are excessive air bubbles in radiator, coolant spurts back		◎	
Trouble-shooting	Pressure-tightness test of cylinder head shows there is leakage		●	
	Remove and inspect oil pan directly			●
Remedy		Replace	Replace	Replace

S-12 Oil pressure drops

General causes why oil pressure drops

- Leakage, clogging, wear of lubrication system
- Defective oil pressure control
- Improper selection of fuel (improper viscosity)
- Deterioration of oil due to overheating

		Causes									
		Worn journal of bearing	Lack of oil in oil pan	Coolant, fuel in oil	Clogged strainer in oil pan	Clogged, broken pipe in oil pan	Defective oil pump	Defective regulator valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective oil level switch or defective wiring harness
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△				△		△		
	Oil pressure monitor indicates low oil pressure							○	○		
	Non-specified oil is being used		○						○		
	Replacement of filters has not been carried out according to Operation and Maintenance Manual								○		
	Oil pressure monitor (if installed)	Indicates pressure drop at low idle	○								
		Indicates pressure drop at low, high idle		○	○	○	○	○			
		Indicates pressure drop on slopes		○							
		Sometimes indicates pressure drop						○			○
	Oil level in oil pan is low		○								
Check items	External hydraulic piping is leaking, crushed									○	
	Oil is milky or smells of diesel oil			○							
	Metal particles are found when oil pan is drained	○									
	Metal particles are found when oil filter is drained	○					○				
Troubleshooting	Metal particles are found in oil filter	●									
	Inspect oil pan strainer, pipe directly				●	●					
	Oil pump rotation is heavy, there is play in oil pump						●				
	Valve spring of regulator valve is fatigued, damaged							●			
	Inspect oil filter directly								●		
	Measured oil pressure is within standard value										●
Remedy		Clean	Add	—	Clean	Clean	Replace	Adjust	Clean	Correct	Replace

S-13 Oil level rises (Entry of coolant/fuel)

General causes why oil level rises

- Coolant in oil (milky)
- Fuel in oil (smells diluted diesel fuel)
- ★ If oil is in coolant, carry out troubleshooting for "S-11 Oil is in coolant".

		Causes					
		Broken cylinder head, head gasket	Defective nozzle holder sleeve	Cracks inside cylinder block	Clogged water pump breather hole	Defect in fuel injection pump	Defective thermostat seat
Questions	Confirm recent repair history						
	Degree of use of machine Operated for long period		△		△		
	Fuel must be added more frequently					◎	○
	Coolant must be added more frequently	○	○	○	○		
	There is oil in coolant	○		○			
	Oil smells of diesel fuel		◎			◎	○
	Exhaust gas color is white	○					○
	When engine is started, drops of water come from muffler	○	◎				
Check items	When radiator cap is removed and engine is run at low idle, an abnormal number of bubbles appear, or coolant spurts back	◎					
	After water pump breather hole is cleaned, water flows out				◎		

Troubleshooting	When compression pressure is measured, it is found to be low	●					
	Leakage is detected by pressure test on cylinder head		●				
	Inspect cylinder block directly			●			
	Remove water pump and check it directly				●		
	Remove fuel injection pump and check it directly					●	
	There is defective contact on thermostat seat valve						●
Remedy		Replace	Replace	Replace	Replace	Replace	Correct

S-14 Coolant temperature becomes too high (overheating)

General causes why coolant temperature becomes too high

- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Problem in coolant circulation system

		Causes								
		Broken cylinder head, head gasket	Lack of coolant	Broken water pump	Defective operation of thermostat	Clogged, crushed radiator fins	Clogged radiator core	Defective radiator cap (pressure valve)	Slipping fan belt, worn fan pulley	Defective coolant temperature gauge
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△			△	△			
	Condition of overheating	Suddenly overheated		○	○				○	
		Always tends to overheat			○	○	○		○	
	Coolant temperature gauge (if installed)	Rises quickly		○	○					
		Does not go down from red range								○
Check items	Radiator coolant level monitor indicates drop of coolant level (if monitor is installed)			○						
	Engine oil level has risen and oil is milky									
	Fan belt tension is low								○	
	When fan belt is turned, it has play				○					
	There are excessive air bubbles in radiator, coolant spurts back		○							
	When light bulb is held behind radiator core, no light passes through					○				
	Radiator shroud, inside of underguard are clogged with dirt or mud					○			○	
	Coolant is leaking because of cracks in hose or loose clamps			○						
	Coolant flows out from radiator overflow hose							○		
	Fan belt whines under sudden acceleration								○	
Troubleshooting	When compression pressure is measured, it is found to be low		●							
	Temperature difference between upper and lower tanks of radiator is large			●						
	When operation of thermostat is carried out, it does not open at cracking temperature				●					
	Temperature difference between upper and lower tanks of radiator is slight					●				
	Inspect radiator core directly						●			
	When operation of radiator cap is carried out, its cracking pressure is low							●		
	Inspect fan belt, pulley directly								●	
	When coolant temperature is measured, it is found to be normal									●
Remedy		Replace	Add	Replace	Replace	Correct	Correct	Replace	Correct	Replace

S-15 Abnormal noise is made

General causes why abnormal noise is made

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system
- ★ Judge if the noise is an internal noise or an external noise before starting troubleshooting.

		Causes									
Questions											
Check items	Confirm recent repair history										
	Degree of use of machine	Operated for long period				△					
	Condition of abnormal noise	Gradually occurred				○		○			
		Suddenly occurred	○					○			
	Non-specified fuel is being used								○		
	Oil must be added more frequently					○					
	Metal particles are found when oil filter is drained					○		○			
	When engine is cranked, interference sound is generated around turbocharger										
	When engine is cranked, abnormal sound is generated around cylinder head		○		○						
	When engine is cranked, beat noise is generated around muffler		○								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low								○	○	
	Color of exhaust gas	Blue under light load				○					
		Black			○						
	Engine does not pick up smoothly and combustion is irregular								○		
	Abnormal noise is loud when engine is accelerated				○		○		○		
	Blow-by gas is excessive					○					
Troubleshooting	Inspect dynamic valve system directly		●								
	When muffler is removed, abnormal noise disappears			●							
	Inspect valve clearance directly				●						
	When compression pressure is measured, it is found to be low					●					
	Inspect gear train directly						●	●			
	Inspect fan and fan belt directly								●		
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●	
	Control rack is heavy to push or does not return										●
	Fuel injection rate of tested fuel injection pump is abnormal										●
Remedy		Replace	Replace	Adjust	Replace	Replace	Replace	Correct	Replace	Replace	Adjust

S-16 Vibration is excessive

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Misalignment between engine and chassis
- Abnormal combustion
- ★ If abnormal noise is made and vibration is excessive, carry out trouble-shooting for "S-15 Abnormal noise is made", too.

General causes why vibration is excessive			Causes							
<ul style="list-style-type: none">Defective parts (abnormal wear, breakage)Misalignment between engine and chassisAbnormal combustion★ If abnormal noise is made and vibration is excessive, carry out trouble-shooting for “S-15 Abnormal noise is made”, too.			Stuck dynamic valve system (valve, rocker lever)	Worn main bearing, connecting rod bearing	Improper gear train backlash	Worn camshaft bushing	Defective fuel injection pump (Too much fuel injection)	Loose engine mounting bolts, broken cushions	Broken output shaft, parts in damper	
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period		△		△		△		
	Condition of vibration	Suddenly increased	○						○	
		Gradually increased		○		○		○		
Check items	Non-specified oil is being used			○		○				
	Metal particles are found when oil filter is drained			◎		◎				
	Metal particles are found when oil pan is drained			◎		◎				
	Oil pressure is low at low idle			○		○				
	Vibration occurs at mid-range speed							○	○	
	Vibration follows engine speed				○			○	○	
	Exhaust smoke is black			◎			○			
	Troubleshooting	Inspect dynamic valve system directly			●					
Inspect main bearing and connecting rod bearing directly				●						
Inspect gear train directly					●					
Inspect camshaft bushing directly						●				
Fuel injection rate of tested fuel injection pump is abnormal							●			
Inspect engine mounting bolts and cushions directly								●		
Inspect inside of damper directly								●		
		Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Replace	

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

Form No. SEN04385-00

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HYDRAULIC EXCAVATOR

PC27MR-3
PC30MR-3
PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

100 General information on disassembly and assembly

How to read this manual	2
Coating materials list.....	4
Special tool list	7
Sketches of special tools	11



How to read this manual

1. Removal and installation of assemblies




Special tools

- Special tools which are deemed necessary for removal or installation of parts are described as **A1,••X1** etc. and their part names, part numbers and quantities are described in the special tool list.
- Also the following information is described in the special tool list.
 - 1) Necessity
 - : Special tools that cannot be substituted and should always be used (installed).
 - : Special tools that will be useful if available and are substitutable with commercially available tools.
 - 2) Distinction of new and existing special tools
 - N: Tools newly developed for this model. They respectively have a new part number.
 - R: Tools with upgraded part numbers. They are remodeled from already available tools for other models.
 - Blank: Tools already available for other models. They can be used without any modification.
 - 3) Circle mark ○ in sketch column:
 - The sketch of the special tool is presented in the section of "Sketches of special tools".
 - This mark means part No. of special tools starting with 79*T-***-***** and that they can not be supplied from Komatsu in Japan (i.e. locally made parts).

Removal

- The "Removal" section contains procedures and precautions for implementing the work, know how and the amount of oil or coolant to be drained.
- General tools that are necessary for removal are described as [1], [2]••etc. and their part names, part numbers and quantities are not described.
- Various symbols used in the "Removal" section are explained and listed below.
 - ⚠ : **This mark indicates safety-related precautions that must be followed when implementing the work.**
 - ★ : Know-how or precautions for work
 - [*1] : This mark shows that there are instructions or precautions for installing parts.
 -  : This mark shows the amount of oil or coolant to be drained.
 -  : Weight of part or component

Installation

- Except where otherwise instructed, installation of parts is done in the reverse order to removal.
- Instructions and precautions for installing parts are shown with [*1] mark in the "Installation" Section, identifying which step the instructions are intended for.
- General tools that are necessary for installation are described as [1], [2]••etc. and their part names, part numbers and quantities are not described.
- Marks shown in the "Installation" section stand for the following.
 - ⚠ : **Precautions related to safety in execution of work.**
 - ★ : This mark gives guidance or precautions when doing the procedure.
 -  : Type of coating material
 -  : Tightening torque
 -  : Quantity of oil or coolant to be added

Sketches of special tools



- Various special tools are illustrated for the convenience of local manufacture.

2. Disassembly and assembly of assemblies





Special tools

- Special tools which are deemed necessary for disassembly or assembly of parts are described as **A1,●●X1** etc. and their part names, part numbers and quantities are described in the special tool list.
 - Also the following information is described in the special tool list.
- 1) Necessity
 - : Special tools that cannot be substituted and should always be used (installed).
 - : Special tools that will be useful if available and are substitutable with commercially available tools.
 - 2) Distinction of new and existing special tools
 - N : Tools newly developed for this model. They respectively have a new part number.
 - R : Tools with upgraded part numbers. They are remodeled from already available tools for other models.
 - Blank: Tools already available for other models. They can be used without any modification.
 - 3) Circle mark ○ in sketch column:
 - The sketch of the special tool is presented in the section of "Sketches of special tools".
 - This mark means part No. of special tools starting with 79*T-***-**** and that they can not be supplied from Komatsu in Japan (i.e. locally made parts).

Disassembly

- In "Disassembly" section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant drained are described.
 - General tools that are necessary for disassembly are described as [1], [2]●●etc. and their part names, part numbers and quantities are not described.
 - The meanings of the symbols used in "Disassembly" section are as follows.
-  : **This mark indicates safety-related precautions that must be followed when implementing the work.**
- ★ : Know-how or precautions for work
-  : Quantity of oil or coolant drained

Assembly

- In "Assembly" section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant added are described.
 - General tools that are necessary for assembly are described as [1], [2]●●etc. and their part names, part numbers and quantities are not described.
 - The meanings of the symbols used in "Assembly" section are as follows.
-  : **Precautions related to safety in execution of work**
- ★ : This mark gives guidance or precautions when doing the procedure.
-  : Type of coating material
-  : Tightening torque
-  : Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

Coating materials list

(Rev. 2007.06)

- ★ The recommended coating materials such as adhesives, gasket sealants, and greases used for disassembly and assembly are listed below.
- ★ For coating materials not listed below, use the equivalent of products shown in this manual.

Category	Komatsu code	Part number	Q'ty	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	<ul style="list-style-type: none"> Used to prevent rubber gaskets, rubber cushions, and cork plugs from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	<ul style="list-style-type: none"> Used for plastic (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal, and non-metal parts which require immediate and strong adhesion.
	LT-2	09940-00030	50 g	Polyethylene container	<ul style="list-style-type: none"> Features: Resistance to heat and chemicals. Used to fix and seal bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardener)	Adhesive: 1 kg Hardener: 500 g	Can	<ul style="list-style-type: none"> Used to stick and seal metal, glass, and plastics.
	LT-4	790-129-9040	250 g	Polyethylene container	<ul style="list-style-type: none"> Used to seal plugs.
	Holtz MH 705	790-129-9120	75 g	Tube	<ul style="list-style-type: none"> Heat-resistant seal used to repair engines.
	ThreeBond 1735	790-129-9140	50 g	Polyethylene container	<ul style="list-style-type: none"> Quick-setting adhesive. Setting time: Within 5 sec. to 3 min. Used mainly to stick metals, rubbers, plastics, and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	<ul style="list-style-type: none"> Quick-setting adhesive. Quick-setting type. (max. strength is obtained after 30 minutes) Used mainly to stick rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	<ul style="list-style-type: none"> Features: Resistance to heat and chemicals. Used for fitted portions used at high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	<ul style="list-style-type: none"> Used to stick or seal gaskets and packings of power train case, etc.
	LG-5	790-129-9080	1 kg	Polyethylene container	<ul style="list-style-type: none"> Used to seal various threaded portions, pipe joints, and flanges. Used to seal tapered plugs, elbows, and nipples of hydraulic piping.
	LG-6	790-129-9020	200 g	Tube	<ul style="list-style-type: none"> Features: Silicon-based heat and cold-resistant sealant. Used to seal flange surfaces and threaded portions. Used to seal oil pan, final drive case, etc.
	LG-7	790-129-9070	1 kg	Tube	<ul style="list-style-type: none"> Features: Silicon-based quick-setting sealant. Used to seal flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	LG-8 ThreeBond 1207B	419-15-18131	100 g	Tube	<ul style="list-style-type: none"> Features: Silicon-based, heat and cold-resistant, vibration-resistant, impact-resistant sealant. Used to seal transfer case, etc.

Cate- gory	Komatsu code	Part number	Q'ty	Container	Main features and applications
Gasket sealant	LG-9 ThreeBond 1206D	790-129-9310	200 g	Tube	<ul style="list-style-type: none"> Used for rough surfaces such as the circle gear top seal which does not need to be clamped, water resistance of the clearance at the welded area, etc. Can be coated with paint.
	LG-10 ThreeBond 1206E	790-129-9320	200 g	Tube	<ul style="list-style-type: none"> Used as lubricant/sealant when the radiator hoses are inserted. Can be coated with paint.
	LG-11 ThreeBond 1121	790-129-9330	200 g	Tube	<ul style="list-style-type: none"> Feature: Can be used together with gaskets. Used for covers of the transmission case and steering case etc.
	ThreeBond 1211	790-129-9090	100 g	Tube	<ul style="list-style-type: none"> Gasket sealant used to repair engine.
Molybdenum disulfide lubricant	LM-P	09940-00040	200 g	Tube	<ul style="list-style-type: none"> Used to prevent scuffing and seizure of press-fitted portions, shrink-fitted portions, and threaded portions. Used to lubricate linkages, bearings, etc.
Seizure prevention compound	LC-G NEVER-SEEZ	—	—	Can	<ul style="list-style-type: none"> Feature: Seizure and scuffing prevention compound with metallic super-fine-grain, etc. Used for the mounting bolt in the high temperature area of the exhaust manifold and the turbo-charger, etc.
Grease	G2-LI G0-LI *: For cold district	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI SYG0-400LI-A (*) SYG0-160CNLI (*)	Various	Various	<ul style="list-style-type: none"> Feature: Lithium grease with extreme pressure lubrication performance. General purpose type.
	Molybdenum disulfide grease LM-G (G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g x 10 400 g x 20 16 kg	Bellows-type container Can	<ul style="list-style-type: none"> Used for parts under heavy load. <p>Caution:</p> <ul style="list-style-type: none"> Do not apply grease to rolling bearings like swing circle bearings, etc. and spline. The grease should be applied to work equipment pins at their assembly only, not applied for greasing afterwards.
	Hyper White Grease G2-T, G0-T (*) *: For cold district	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400 g 16 kg	Bellows-type container Can	<ul style="list-style-type: none"> Seizure resistance, heat resistance and water resistance higher than molybdenum disulfide grease. Not conspicuous on machine since color is white.
	Biogrease G2-B, G2-BT (*) *: For use at high temperature and under high load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400 g 16 kg	Bellows-type container Can	<ul style="list-style-type: none"> Since this grease is decomposed by natural bacteria in short period, it has less effects on micro-organisms, animals, and plants.
	G2-S ThreeBond 1855	—	200 g	Tube	<ul style="list-style-type: none"> Feature: Silicone grease with wide using temperature range, high resistance to thermal-oxidative degradation and performance to prevent deterioration of rubber and plastic parts. Used for oil seals of the transmission, etc.
	G2-U-S ENS grease	427-12-11871	2 kg	Can	<ul style="list-style-type: none"> Feature: Urea (organic system) grease with heat resistance and long life. Enclosed type. Used for rubber, bearing and oil seal in damper. <p>Caution: Do not mix with lithium grease.</p>

Category	Komatsu code	Part number	Q'ty	Container	Main features and applications	
Primer	SUNSTAR PAINT PRIMER 580 SUPER	417-926-3910	20 ml	Glass container	Adhesive for cab glass	<ul style="list-style-type: none"> Used as primer for cab side. (Using limit: 4 months after date of manufacture)
	SUNSTAR GLASS PRIMER 580 SUPER		20 ml	Glass container		<ul style="list-style-type: none"> Used as primer for glass side. (Using limit: 4 months after date of manufacture)
	SUNSTAR PAINT PRIMER 435-95	22M-54-27230	20 ml	Glass container		<ul style="list-style-type: none"> Used as primer for painted surface on cab side. (Using limit: 4 months after date of manufacture)
	SUNSTAR GLASS PRIMER 435-41	22M-54-27240	150 ml	Can		<ul style="list-style-type: none"> Used as primer for black ceramic-coated surface on glass side and for hard polycarbonate-coated surface. (Using limit: 4 months after date of manufacture)
	SUNSTAR SASH PRIMER GP-402	22M-54-27250	20 ml	Glass container		<ul style="list-style-type: none"> Used as primer for sash (Almite). (Using limit: 4 months after date of manufacture)
Adhesive	SUNSTAR PENGUINE SEAL 580 SUPER "S" or "W"	417-926-3910	320 ml	Polyethylene container	Adhesive for cab glass	<ul style="list-style-type: none"> "S" is used for high-temperature season and "W" for low-temperature season as adhesive for glass. (Using limit: 4 months after date of manufacture)
	Sika Japan, Sikaflex 256HV	20Y-54-39850	310 ml	Polyethylene container		<ul style="list-style-type: none"> Used as adhesive for glass. (Using limit: 6 months after date of manufacture)
	SUNSTAR PENGUINE SUPER 560	22M-54-27210	320 ml	Ecocart (Special container)		<ul style="list-style-type: none"> Used as adhesive for glass. (Using limit: 6 months after date of manufacture)
Caulking material	SUNSTAR PENGUINE SEAL No. 2505	417-926-3920	320 ml	Polyethylene container	Adhesive for cab glass	<ul style="list-style-type: none"> Used to seal joints of glass parts. (Using limit: 4 months after date of manufacture)
	SEKISUI SILICONE SEALANT	20Y-54-55130	333 ml	Polyethylene container		<ul style="list-style-type: none"> Used to seal front window. (Using limit: 6 months after date of manufacture)
	GE TOSHIBA SILICONES TOSSEAL 381	22M-54-27220	333 ml	Cartridge		<ul style="list-style-type: none"> Used to seal joint of glasses. Translucent white seal. (Using limit: 12 months after date of manufacture)

Special tool list

- ★ Tools with part number 79○T-○○○-○○○○ cannot be supplied (they are items to be locally manufactured).
- ★ Necessity: ■Cannot be substituted, must always be installed (used).
 ●Extremely useful if available or, can be substituted with commercially available part.
- ★ New/Remodel: NTools with new part numbers, newly developed for this model.
 : RTools with upgraded part numbers, remodeled from items already available for other models.
 : Blank: ...Tools already available for other models, can be used without any modification.
- ★ Tools marked ○ in the Sketch column are tools introduced in the sketches of the special tools (See Sketches of special tools).

Component	Symbol	Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks
Disassembly, assembly of swing motor and swing machinery assembly	F	1 796T-126-1210	Wrench	■	1	N	○	Removal, installation of nut
		2 790-101-5001	Push tool KIT	■	1			Press fitting of oil seal
		790-101-5151	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
		3 790-101-5201	Push tool KIT	●	1			Press fitting of outer race (small)
		790-101-5271	• Plate		1			
		790-101-5221	• Grip		1			
		01010-51225	• Bolt		1			
		4 790-101-5201	Push tool KIT	●	1			Press fitting of outer race (large)
		790-101-5331	• Plate		1			
		790-101-5221	• Grip		1			
		01010-51225	• Bolt		1			
Disassembly, assembly of swing motor and swing machinery assembly		5 796-760-9110	Push tool	■	1			Press fitting of bearing (small)
		6 790-445-3810	Push tool	■	1			Press fitting of bearing (large)
Disassembly, assembly of idler assembly	L	1 790-101-5001	Push tool KIT	●	1			Press fitting of bushing
		790-101-5081	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
		2 791-430-3230	Installer	■	1			Installation of floating seal

Component	Symbol	Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks
Disassembly, assembly of track roller assembly	3	790-101-5001	Push tool KIT	●	1			Press fitting of bushing
		790-101-5051	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
	4	790-434-1660	Installer	■	1			Installation of floating seal
Disassembly, assembly of carrier roller	5	790-101-5001	Push tool KIT	●	1			Press fitting of ball bearing and cap
		790-101-5081	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
	6	790-101-5001	Push tool KIT	●	1			Press fitting of dust seal
		790-101-5111	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
Disassembly, assembly of recoil spring assembly	M	792-371-1400	Sleeve	■	1			Disassembly, assembly of recoil spring assembly
Disassembly, assembly of center swivel joint assembly	T	790-101-2501	Push puller	●	1			Separation of rotor and swivel joint
		790-101-2510	• Block		1			
		790-101-2520	• Screw		1			
		791-112-1180	• Nut		1			
		790-101-2540	• Washer		1			
		790-101-2630	• Leg		2			
		790-101-2570	• Plate		4			
		790-101-2560	• Nut		2			
		790-101-2660	• Adapter		2			

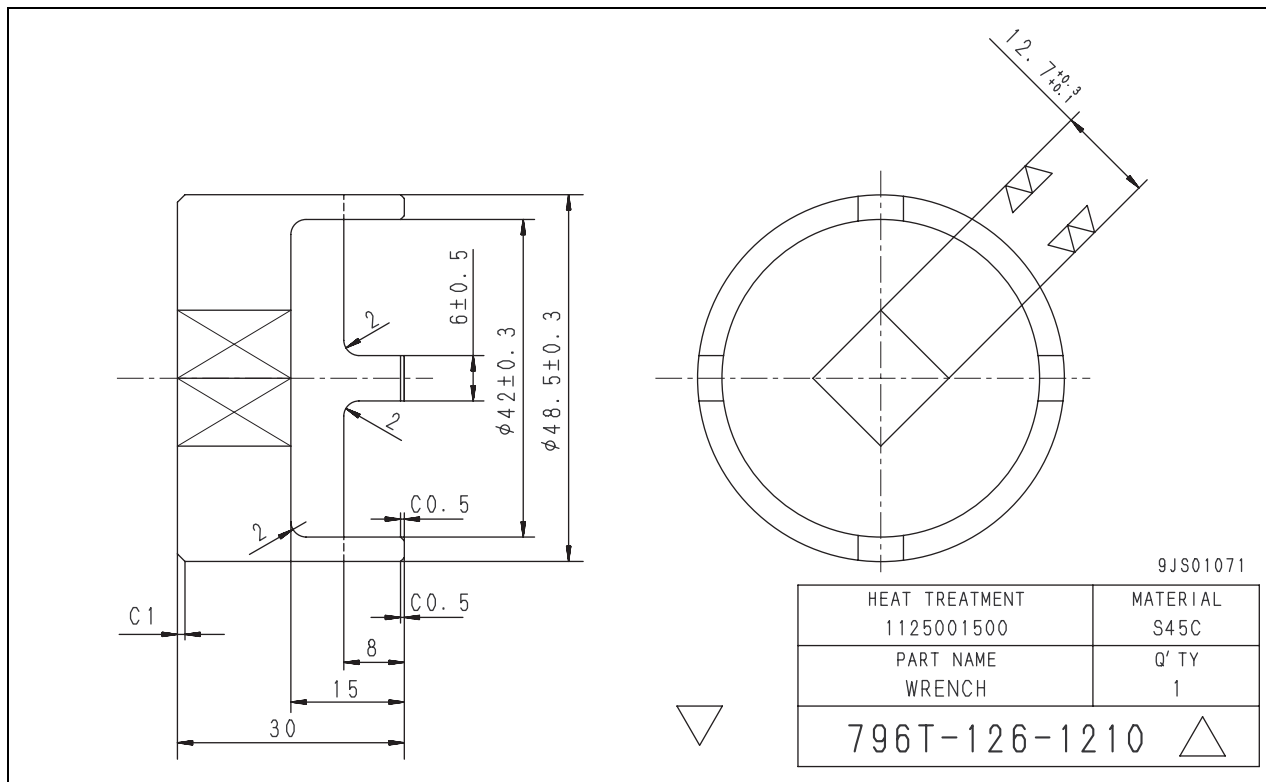
Component	Symbol	Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks		
Disassembly, assembly of hydraulic cylinder assembly	U	1	790-502-1003	■	1			Disassembly, assembly of hydraulic cylinder assembly		
			790-101-1102	■	1					
		2	790-330-1100	Wrench assembly	■	1			Removal, installation of cylinder head	
		3	Commercially available	Socket	■	1			Width across flats: 41 mm	Removal, installation of piston nut
			Commercially available	Socket	■	1			Width across flats: 46 mm	
			790-302-1390	Socket	■	1			Width across flats: 46 mm, long type	
			790-302-1270	Socket	■	1			Width across flats: 50 mm	
			790-302-1490	Socket	■	1			Width across flats: 50 mm, long type	
			790-302-1280	Socket	■	1			Width across flats: 55 mm	
			790-302-1470	Socket	■	1			Width across flats: 55 mm, long type	
		4	790-201-1702	Push tool KIT	■	1			Press fitting of bushing	
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1731	• Push tool		1				
			790-201-1751	• Push tool		1				
			790-201-1741	• Push tool		1				
			790-201-1761	• Push tool		1				
		5	790-201-1500	Push tool KIT	■	1			Press fitting of dust seal	
			790-101-5021	• Grip		1				
			01010-50816	• Bolt		1				
			790-201-1540	• Plate		1				
			790-201-1560	• Plate		1				
			790-201-1550	• Plate		1				
			790-201-1570	• Plate		1				
		6	790-720-1000	Expander	●	1			PC27MR-3: boom, swing PC30MR-3: boom, arm, swing PC35MR-3: boom, arm	Installation of piston ring
		7	796-720-1630	Ring	●	1			PC27MR-3: bucket	
			07281-00709	Clamp	●	1				

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ Remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of hydraulic cylinder assembly	U	7	796-720-1640	Ring	●	1			PC27MR-3: boom, swing PC30MR-3: boom, arm, swing PC35MR-3: boom, arm	Install- ation of pis- ton ring
			07281-00909	Clamp	●	1				
			796-720-1740	Ring	●	1			PC27MR-3: arm PC30,35MR-3: bucket	
			07281-00809	Clamp	●	1				
			796-720-1650	Ring	●	1			PC27,30MR-3: blade PC35MR-3: swing, blade	
			07281-01029	Clamp	●	1				
Removal, installation of operator's cab glass (stuck glass)	X	2	793-498-1210	Lifter (Suction cup)	■	2			Fixing of window glass	

Sketches of special tools

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches

F1. Wrench



PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04386-00

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

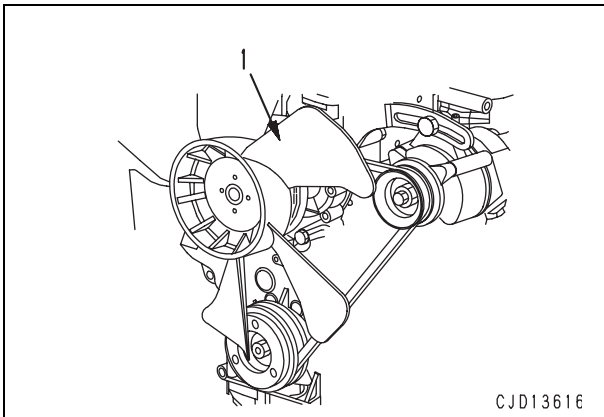
200 Engine and cooling system

Removal and installation of fuel injection pump assembly.....	2
Removal and installation of radiator and hydraulic oil cooler assembly.....	5
Removal and installation of engine and hydraulic pump assembly	9

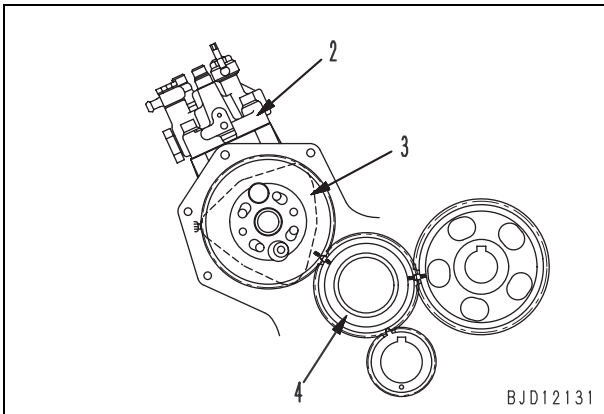
Removal and installation of fuel injection pump assembly

Removal

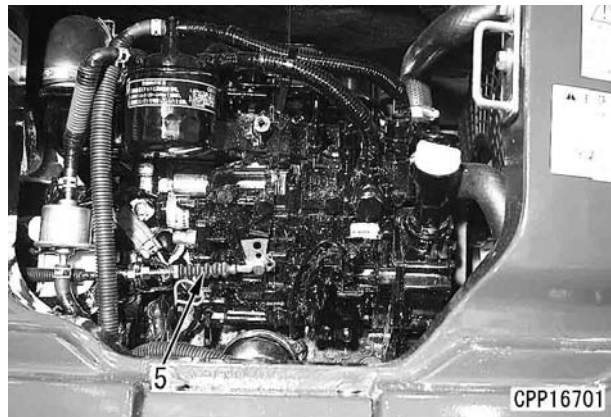
1. Tilt up the floor frame.
For details, see Testing and adjusting, "How to open and close (tilt) floor".
2. Loosen the fan belt and remove fan (1). [*1]
★ Before removing fan (1), make a match mark on it and mounting part.



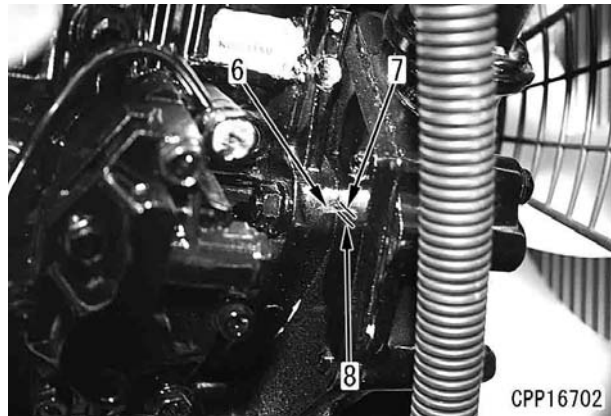
3. Before removing fuel injection pump (2), remove the front cover of the timing gear case and make match marks with paint on the meshing parts of pump drive gear (3) and idle gear (4).



4. Disconnect fuel control cable (5) from the fuel injection pump.



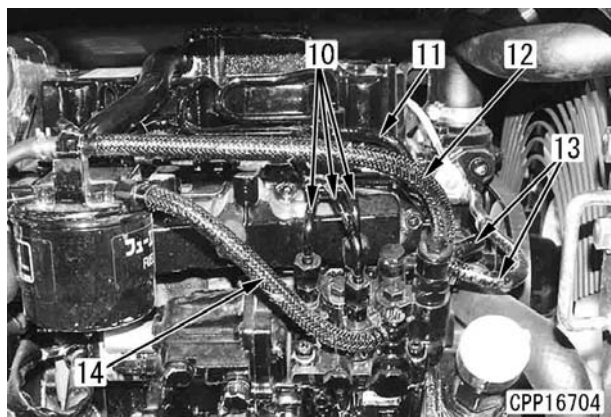
5. Take an accurate record of the positions of stamp line (6) of the fuel injection pump body and stamp line (7) of the gear case by making mark (8) on the gear case.



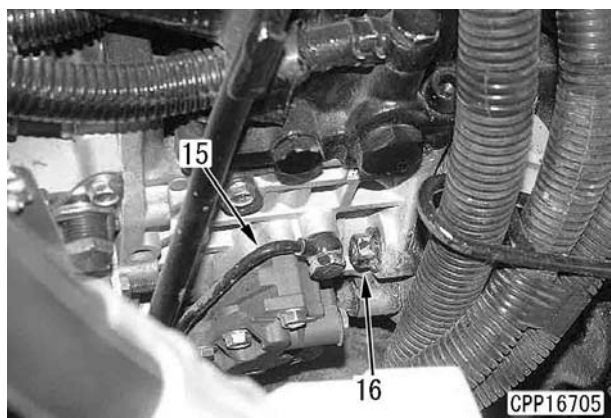
6. Remove the 3 bracket mounting bolts and remove water separator and bracket assembly (9).



7. Remove 3 fuel tubes (10). [^{*2}]
8. Disconnect fuel return hose (11).
9. Disconnect fuel hoses (12) and (14) and engine stop solenoid connector.
10. Disconnect cooling hoses (13).

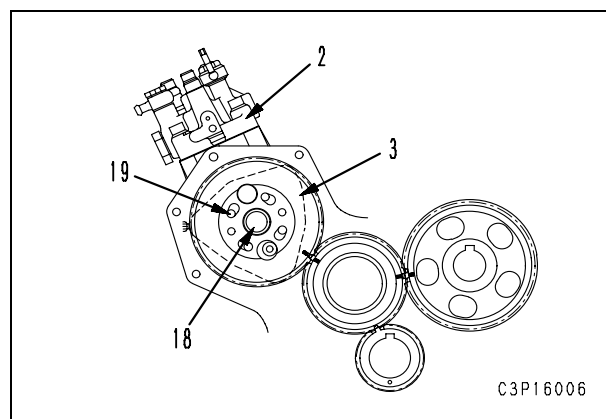


11. Remove lubrication tube (15) and 3 fuel injection pump mounting nuts (16).



12. Remove nut (18) from the end of the fuel injection pump drive shaft. [^{*3}]
 ★ Take care not to drop the nut into the case.
 ★ Never loosen mounting bolts (19) of pump drive gear (3) and flange. (If the flange and pump drive gear move from each other, it becomes very difficult to adjust the injection timing.)

13. Using a puller, push out the pump drive shaft from the gear and remove fuel injection pump assembly (2). [^{*4}]



Installation

- Carry out installation in the reverse order to removal.

[^{*1}]

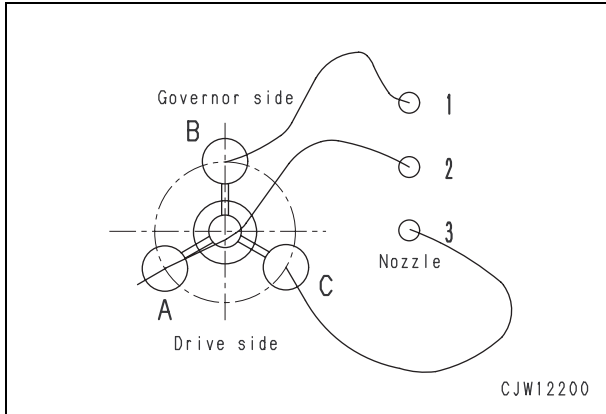
- ★ When installing the fan, line up the match marks.
- ★ Check that the identification mark (M) of the fan is on outside.

- Sample of identification mark




[*2]

- ★ Referring to the following figure, install the fuel tube.
- ★ The cylinder of the engine on the flywheel side is the No. 1 cylinder.



[*3]

 Nut at shaft end:**113 – 123 Nm {11.5 – 12.5 kgm}**

[*4]

- ★ Install the fuel injection pump temporarily, and then tighten the nut at the shaft end first.
- ★ Adjust the injection angle. For details, see Testing and adjusting, "Testing and adjusting fuel injection timing".

Removal and installation of radiator and hydraulic oil cooler assembly

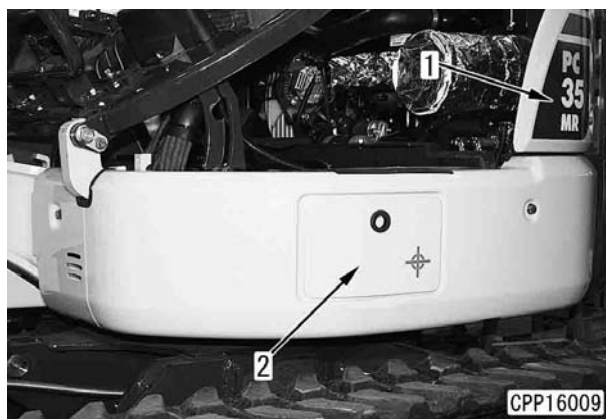
Removal

1. Release the air pressure in the hydraulic tank.
For details, see Testing and adjusting, "Releasing air in hydraulic tank".
2. Tilt up the floor frame.
For details, see Testing and adjusting, "How to open and close (tilt) floor".

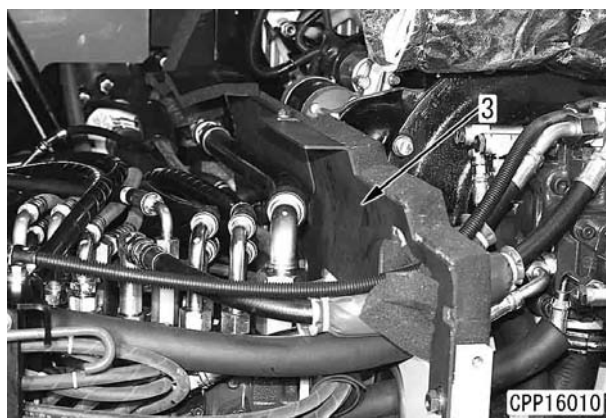
3. Drain the coolant.

 Coolant: **3.3 ℓ**

4. Remove covers (1), (2).

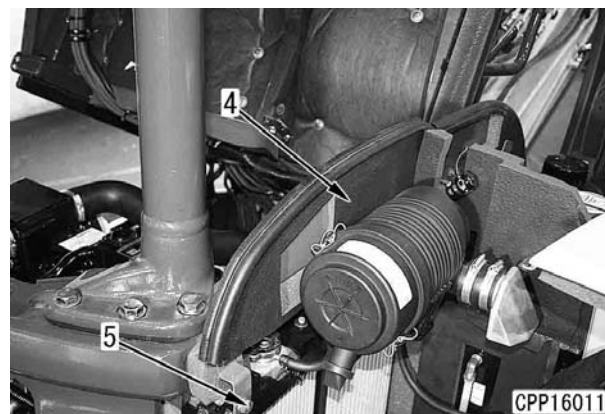


5. Remove all the mounting bolts of plate (3) on the left side of the engine.
★ Since the plate cannot be removed, set it so that it can be removed.



6. Remove plate (4) according to the following procedure.

- 1) Remove bolt (5).



- 2) Open cover (6).

- 3) Remove cover (7).

★ Remove 4 bolts (8) – (11).

★ Bolt (9) is securing the top of cover (7).

★ Bolts (10) and (11) are securing the bottom of cover (7).



- 4) Remove linkage (12).



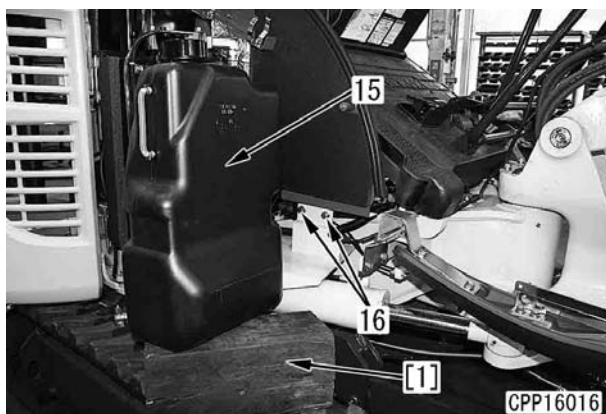
- 5) Disconnect fuel level sensor connector (13).



- 6) Remove fuel tank mounting belt (14).



- 7) Place block [1] on the track and place fuel tank (15) on it.
8) Remove 2 plate mounting bolts (16).



- 9) Remove plate (4).



7. Remove air hose (17)
8. Remove air cleaner case assembly (18).
9. Remove reservoir tank hose (19).



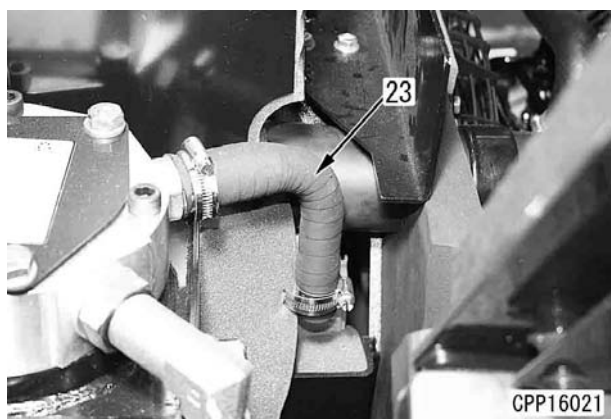
10. Remove battery (20).
11. Remove bracket (21).



12. Remove the assembly of fuel cooler (22) and bracket.



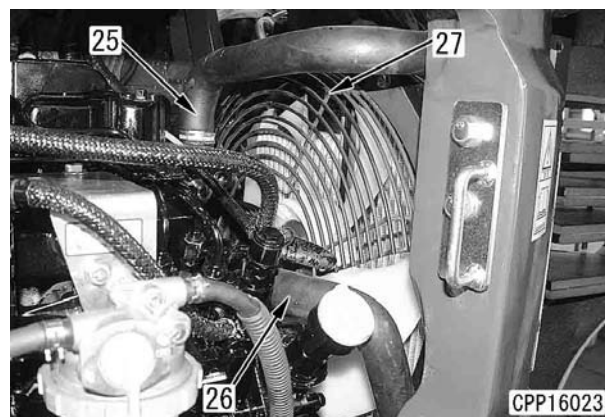
13. Disconnect hoses (23) and (24) from the hydraulic oil cooler.



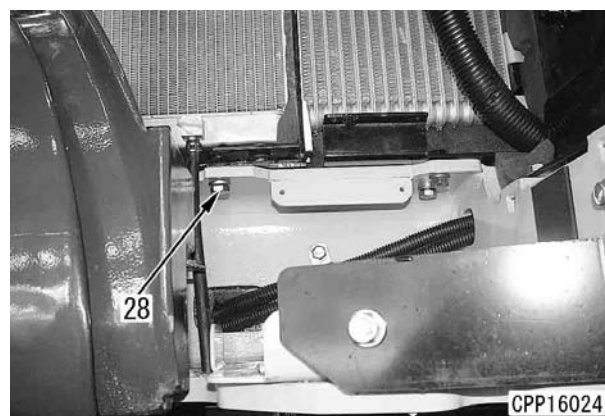
14. Disconnect hoses (25) and (26) from the engine.

★ Hold the nipple on the oil cooler side and loosen the hose.

15. Remove fan guard (27).

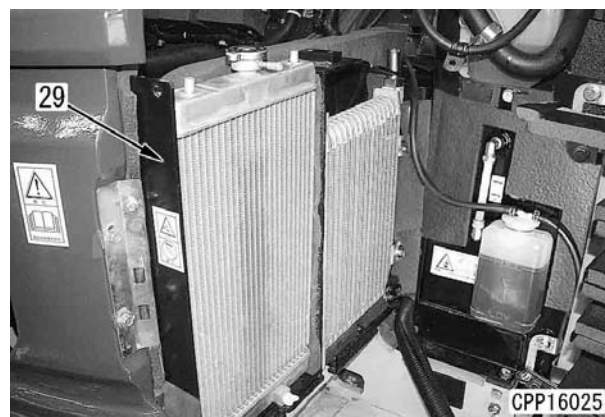


16. Remove 4 mounting bolts (28) on the lower side of the radiator.

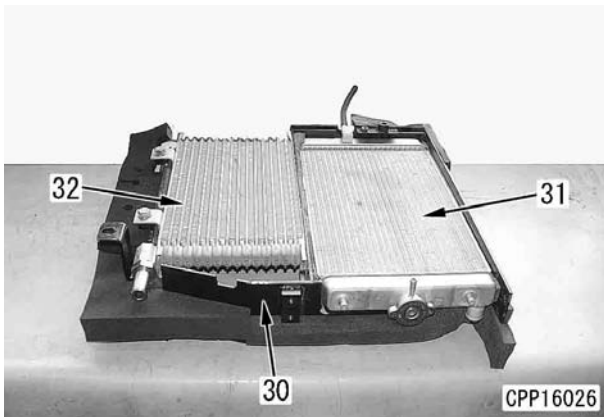


17. Remove radiator and hydraulic oil cooler assembly (29).

★ Moving plate (3) on the left side of the engine (See step 5), remove the assembly. At this time, take care not to damage the core.



18. Remove radiator (31) and hydraulic oil cooler (32) from shroud (30).



Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ Adjust the belt tension. For details, see Testing and adjusting, "Testing and adjusting alternator belt tension".

- **Refilling with coolant**

- ★ Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.



Coolant: 3.3 ℓ

- **Refilling with oil (Hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Removal and installation of engine and hydraulic pump assembly

Removal

⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Release the air pressure in the hydraulic tank.
For details, see Testing and adjusting, “Releasing air in hydraulic tank”.

2. Drain the coolant.

🔧 Coolant: **3.3 ℓ**

3. Drain the hydraulic oil.

🔧 Hydraulic oil: **13.5 ℓ**

4. Tilt up the floor frame.

For details, see Testing and adjusting, “How to open and close (tilt) floor”.

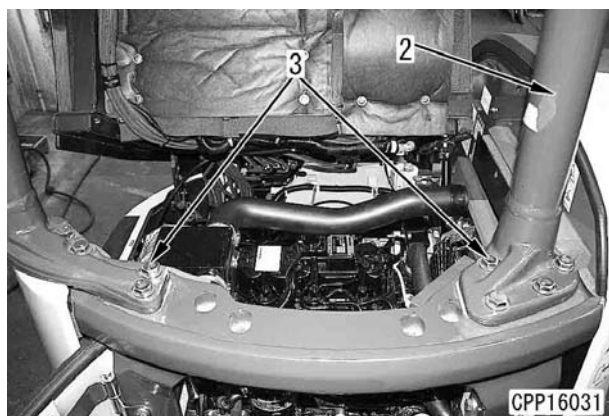
5. Remove canopy according to the following procedure.

★ Canopy specification only.

1) Lift off canopy roof (1).



2) Sling canopy (2) temporarily, remove 8 mounting bolts (3).



3) Lift off canopy (2).

🔧 Canopy: **77 kg**



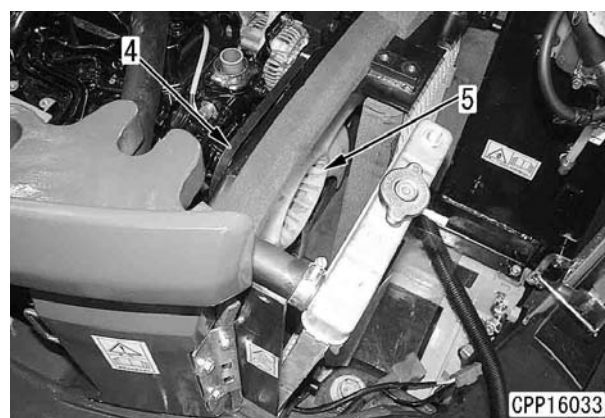
6. Perform the following work. (For details, see “Removal and installation of radiator and hydraulic oil cooler assembly”, steps 4 – 7 and 12 – 15.)

- Removal of cover on left side of machine
- Removal of mounting bolts of plate on left side of engine
- Shifting of plate in front of engine to front of machine
- Removal of air hose
- Removal of air cleaner case
- Separation of 2 radiator hoses
- Removal of fan guard

7. Loosen alternator belt (4).

8. Remove cooling fan (5).

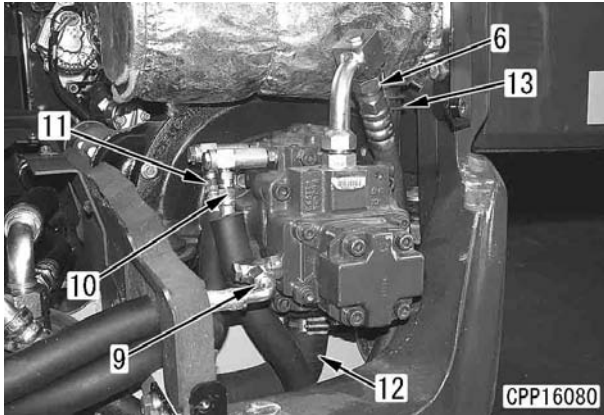
★ This step is to prevent the cooling fan from damage when lifting off engine and hydraulic pump assembly.



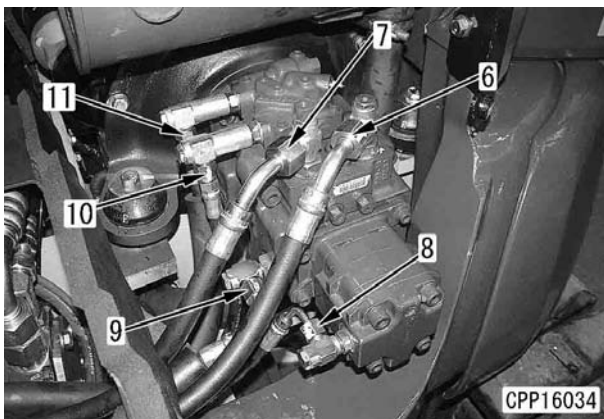
9. Disconnect hoses (6) – (12) from the hydraulic pump.

10. Remove exhaust tube (13).

PC27MR-3, PC30MR-3

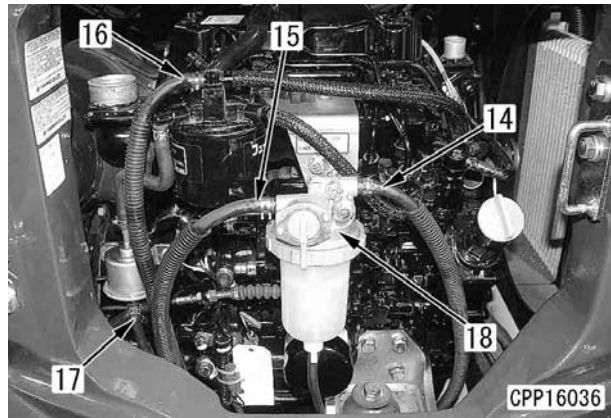


PC35MR-3



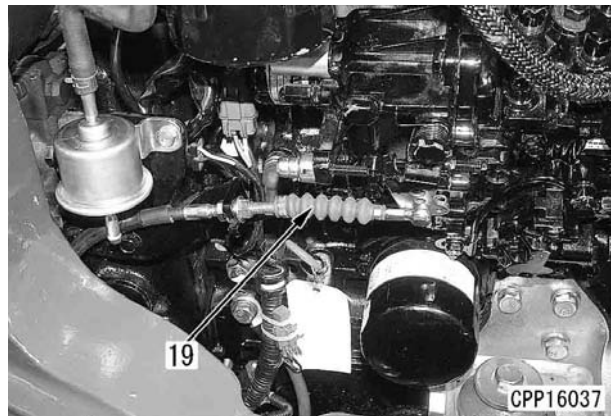
11. Disconnect hoses (14) – (17).

12. Remove water separator (18) and bracket together.



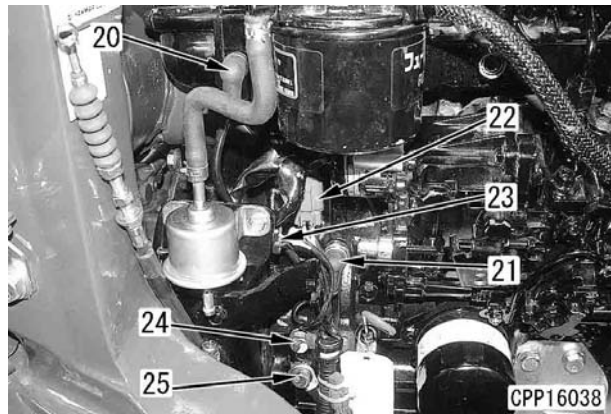
13. Remove fuel control cable (19). [*2]

★ Before removing the fuel control cable, check its installed dimension.

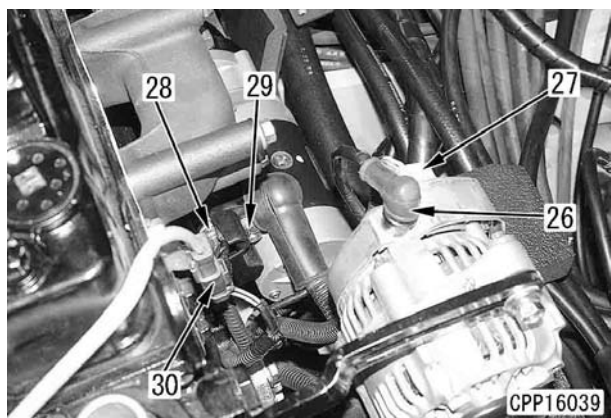


14. Disconnect terminals (20) and (21) and connectors (22) and (23).

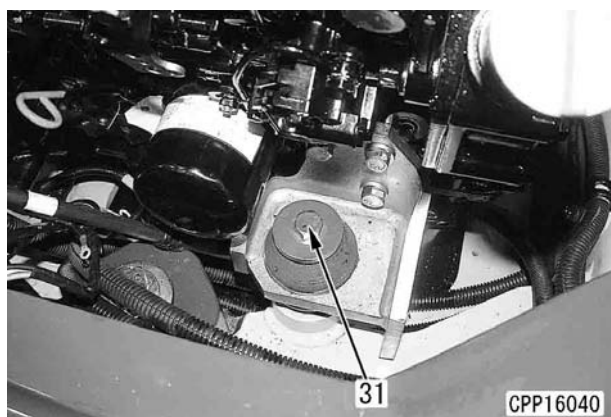
15. Remove wiring harness clamp (24) and ground cable (25).



16. Disconnect terminal (26) and connector (27) from the alternator.
17. Disconnect terminals (28) and (29) from the starting motor.
18. Disconnect connector (30).




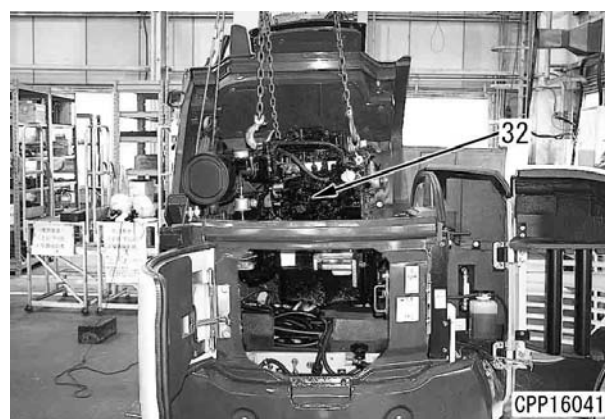
19. Sling the engine and hydraulic pump assembly temporarily.
20. Remove 4 mounting bolts (31).



21. Lift off engine and hydraulic pump assembly (32).

- ★ Check that all the wires and pipes have been disconnected.
- ★ When removing the engine and hydraulic pump assembly, take care that it will not interfere with other parts.

 Engine and hydraulic pump assembly: **230 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ Adjust the belt tension. For details, see Testing and adjusting, "Testing and adjusting alternator belt tension".

[*2]

- ★ Adjust the cable tension. For details, see Testing and adjusting, "Testing and adjusting fuel control lever".


- **Refilling with coolant**

- ★ Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.

 Coolant: **3.3 ℓ**

- **Refilling with oil (Hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

 Hydraulic oil: **13.5 ℓ (EO10-DH)**

- **Bleeding air**

- ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

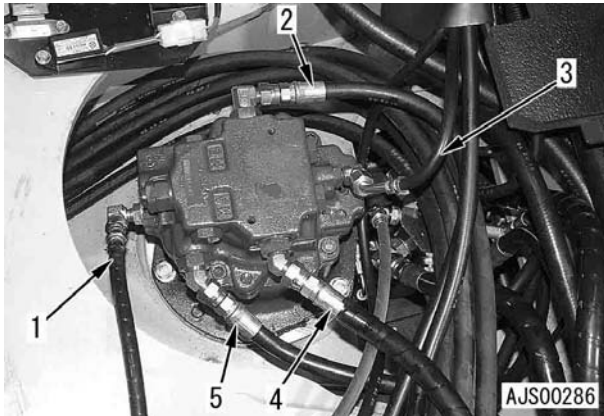
300 Power train


Removal and installation of swing motor and swing machinery assembly	2
Disassembly and assembly of swing motor and swing machinery assembly	3
Removal and installation of swing circle assembly	8

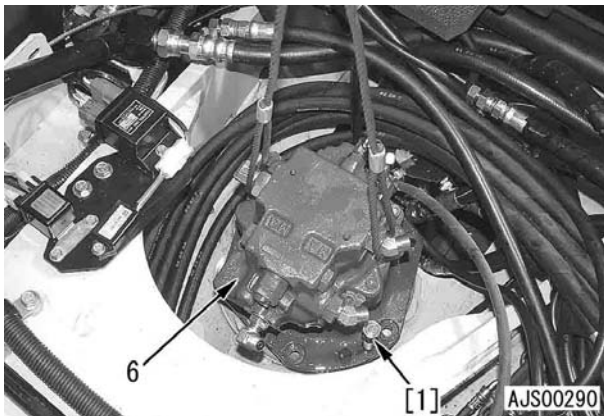
Removal and installation of swing motor and swing machinery assembly

Removal

1. Remove the canopy and floor frame (operator's cab and floor frame) assembly. For details, see "Removal and installation of floor frame assembly".
2. Disconnect hoses (1) – (5).




3. Remove all the mounting bolts and separate the swing machinery from the frame, using forcing screws [1] (2 pieces). [*1]
4. Lift off swing motor and swing machinery assembly (6).
 Swing motor and swing machinery assembly: **35 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

 Mounting bolt:

98 – 123 Nm {10 – 12.5 kgm}

- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".


Disassembly and assembly of swing motor and swing machinery assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F	1 796T-126-1210	Wrench	■	1	N	○
	2 790-101-5001	Push tool KIT	■	1		
	790-101-5151	• Plate		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
	3 790-101-5201	Push tool KIT	●	1		
	790-101-5271	• Plate		1		
	790-101-5221	• Grip		1		
	01010-51225	• Bolt		1		
	4 790-101-5201	Push tool KIT	●	1		
	790-101-5331	• Plate		1		
	790-101-5221	• Grip		1		
	01010-51225	• Bolt		1		
	5 796-760-9110	Push tool	■	1		
	6 790-445-3810	Push tool	■	1		

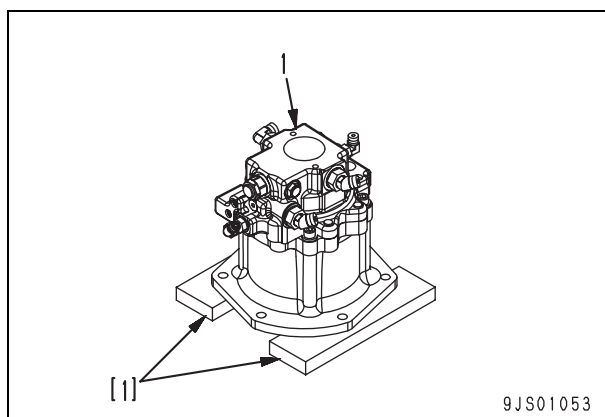
Disassembly

- ★ Since an oil drain plug is not installed, prepare an oil pan, etc. to receive oil flowing out of the case during the disassembly work.

 Swing machinery case: **Approx. 0.9 ℓ**

1. Swing motor assembly

Set the swing motor and swing machinery assembly to blocks [1] and remove swing motor assembly (1).

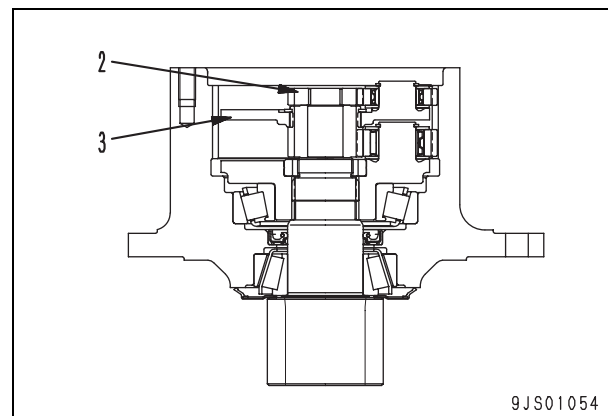


2. No. 1 sun gear

Remove No. 1 sun gear (2).

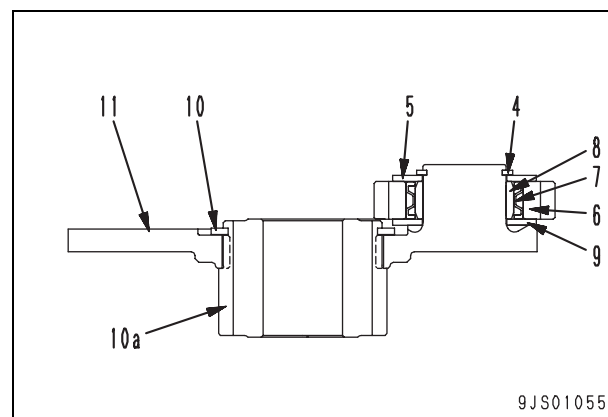
3. No. 1 planetary carrier and No. 2 sun gear assembly

- 1) Remove No. 1 planetary carrier and No. 2 sun gear assembly (3).



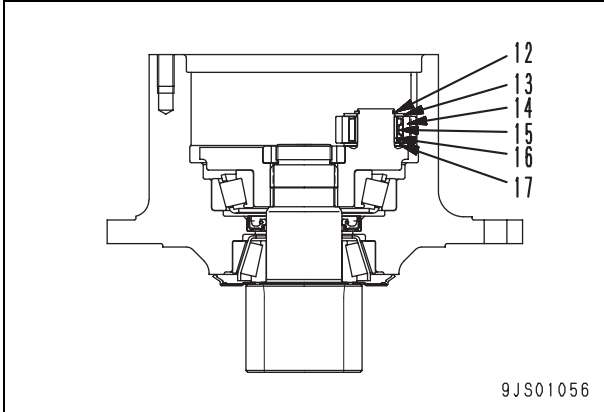
- 2) Remove snap ring (4), thrust washer (5), No. 1 planetary gear (6), needle roller bearing (7), spacer (8), and thrust washer (9).

- 3) Remove snap ring (10), and then remove No. 1 planetary carrier (11) from No. 2 sun gear (10a).

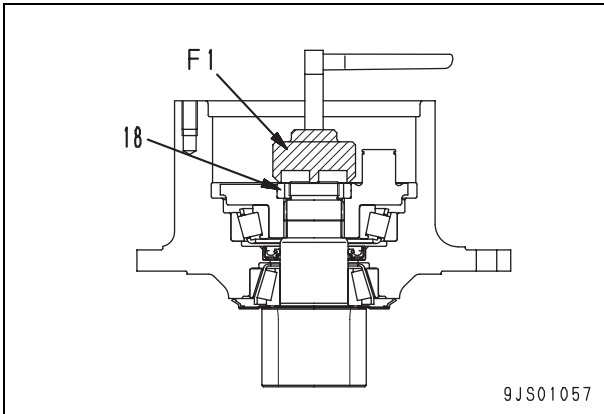


4. No. 2 planetary carrier assembly

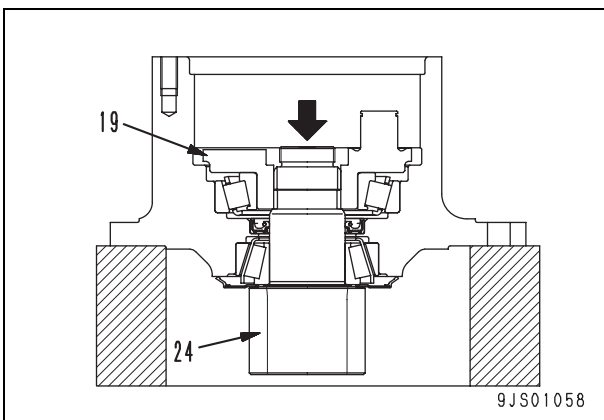
- 1) Remove snap ring (12), thrust washer (13), No. 2 planetary gear (14), needle roller bearing (15), spacer (16), and thrust washer (17).



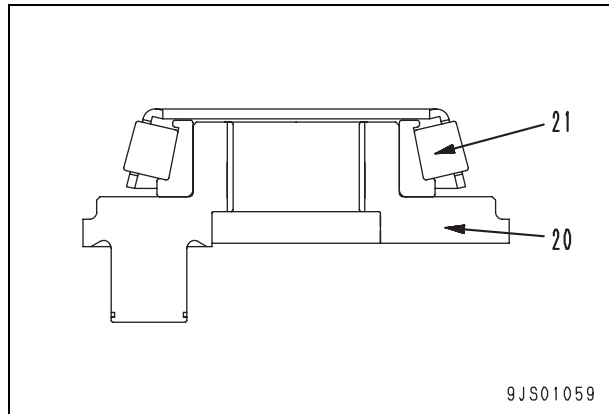
- 2) Using tool **F1**, remove nut (18)



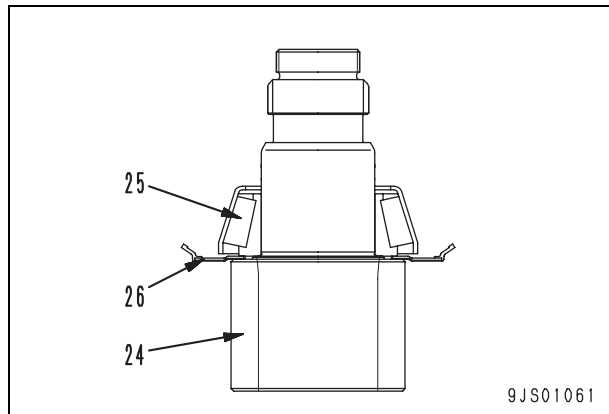
- 3) Remove No. 2 planetary carrier and bearing assembly (19).
★ Using a press, etc., push the end of pinion shaft (24) to remove the No. 2 pinion shaft and bearing assembly.



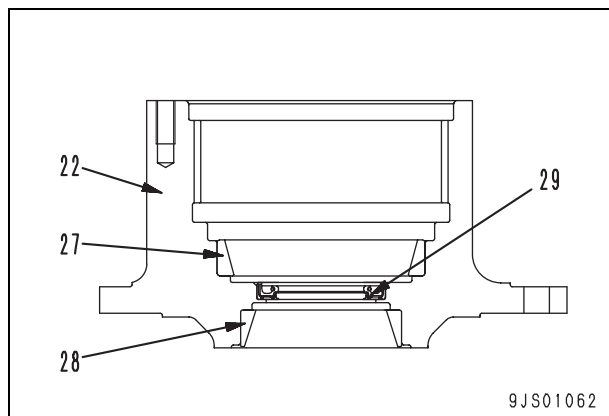
- 4) Remove bearing (21) from No. 2 planetary carrier (20).

**5. Pinion shaft and bearing assembly**

- Remove bearing (25) and seal (26) from pinion shaft (24).

**6. Swing machinery case**

- Remove outer races (27) and (28) and oil seal (29) from swing machinery case (22).




Assembly

1. Swing machinery case

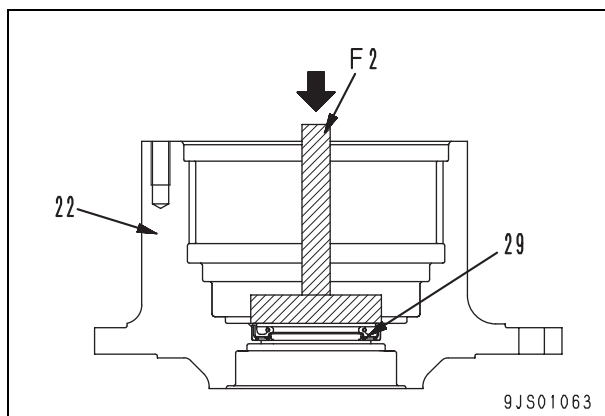
- 1) Using tool **F2**, press fit oil seal (29) to swing machinery case (22) until it is stopped.

★ Install the oil seal with the spring up.

 Press fitting surface of oil seal:

Gasket sealant (LG-6)

- ★ Take care that the gasket sealant will not stick to the oil seal lip and the sliding part of the shaft.

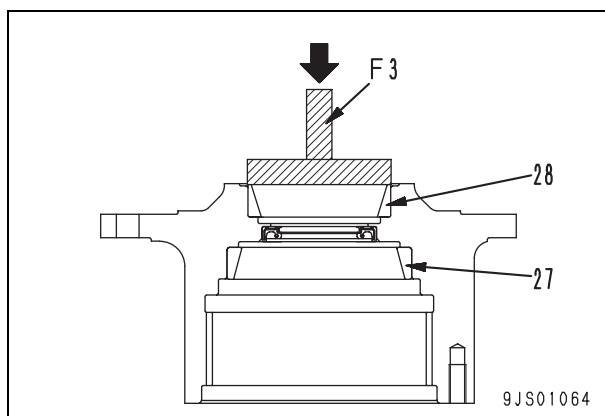


- 2) Using tools **F3** and **F4**, press fit outer races (28) and (27) to the swing machinery case.

★ Tool **F3**: Outer race (28)


Tool **F4**: Outer race (27)

★ The figure shows outer race (28).



2. Pinion shaft and bearing assembly

- 1) Install seal (26) to pinion shaft (24).

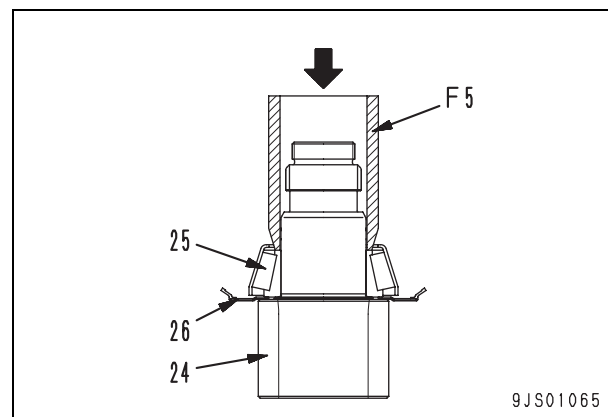
 Sliding surface of seal:

Grease (G2-LI)

- 2) Using tool **F5**, press fit bearing (25) to pinion shaft (24).

● Press fitting force:

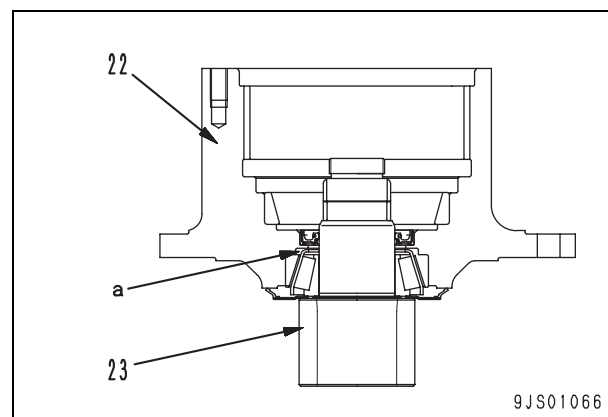
6.67 – 17.06 kN {0.68 – 1.74 ton}



- 3) Set swing machinery case (22) to pinion shaft and bearing assembly (23).

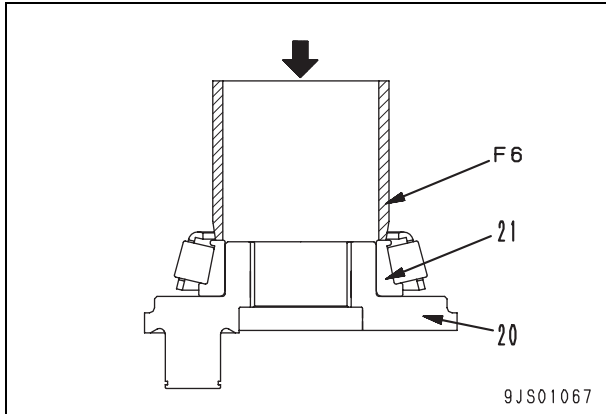
★ Fill space (a) between the swing machinery case and bearing with grease (G2-LI) to 40 – 60%.

★ Take care not to damage the oil seal.

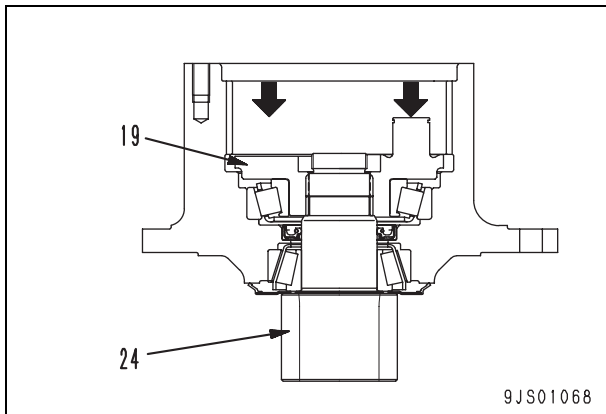


3. No. 2 planetary carrier assembly

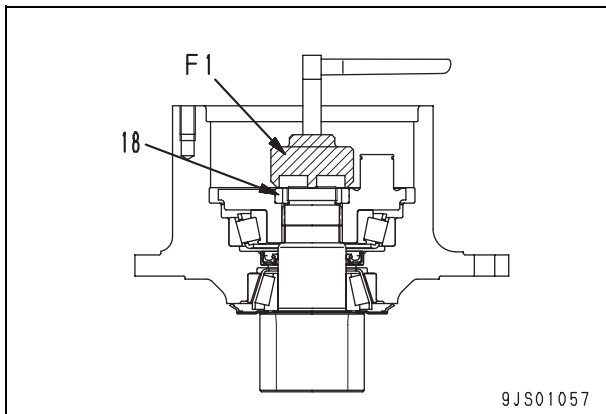
- 1) Using tool **F6**, press fit bearing (21) to No. 2 planetary carrier (20).
 - Press fitting force:
2.94 – 11.18 kN {0.3 – 1.14 ton}



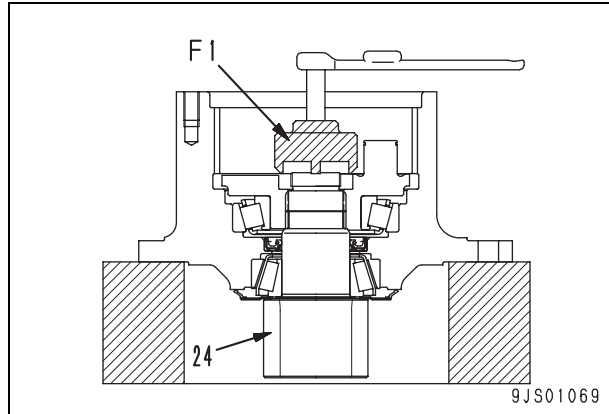
- 2) Set No. 2 planetary carrier and bearing assembly (19) to pinion shaft (24) and press fit it with a press, etc.
 - ★ Turning the case, press fit gradually.
 - 🔧 Spline: **Grease (G2-LI)**
 - Press fitting force:
4.41 – 17.8 kN {0.45 – 1.82 ton}



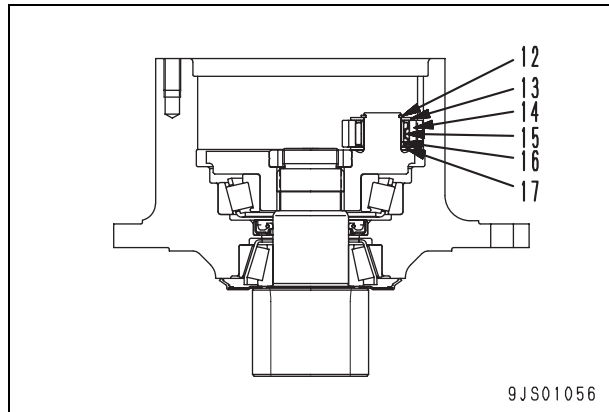
- 3) Using tool **F1**, tighten nut (18).
 - 🔧 Nut: **Adhesive (LT-2)**
 - 🔧 Nut: **245 – 294 Nm {25 – 30 kgm}**



- 4) Using tool **F1**, measure the starting torque of pinion shaft (24) and check that it is in the following range.
 - Starting torque: Max. 13.2 Nm {1.35 kgm}

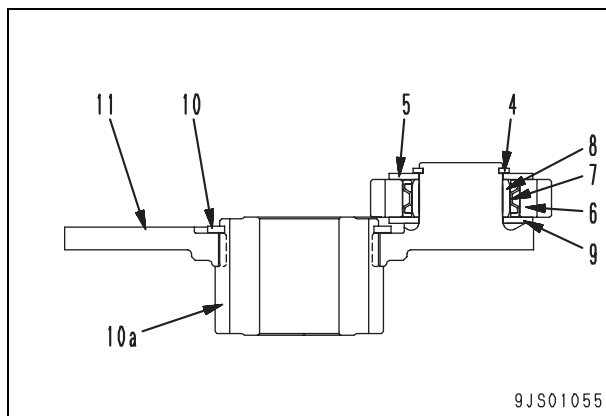


- 5) Install thrust washer (17), spacer (16), needle roller bearing (15), No. 2 planetary carrier (14), thrust washer (13), and snap ring (12).
 - ★ Check that there is no play in the No. 2 planetary gear.



4. No. 1 planetary carrier and No. 2 sun gear assembly

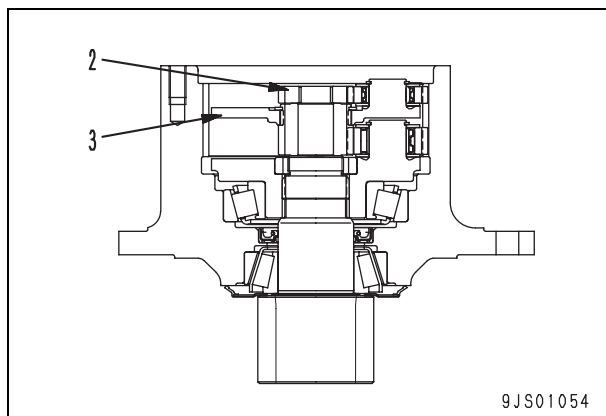
- 1) Install No. 1 planetary carrier (11) to No. 2 sun gear (10a), and then install snap ring (10).
- 2) Install thrust washer (9), spacer (8), needle roller bearing (7), No. 1 planetary gear (6), thrust washer (5), and snap ring (4).
- ★ Check that there is no play in the No. 1 planetary gear.



- 3) Install No. 1 planetary carrier and No. 2 sun gear assembly (3).

5. No. 1 sun gear

Install No. 1 sun gear (2).



6. Filling with oil

Add engine oil into the swing machinery case.



Swing machinery case:

Approx. 0.9 ℓ (EO10-DH)

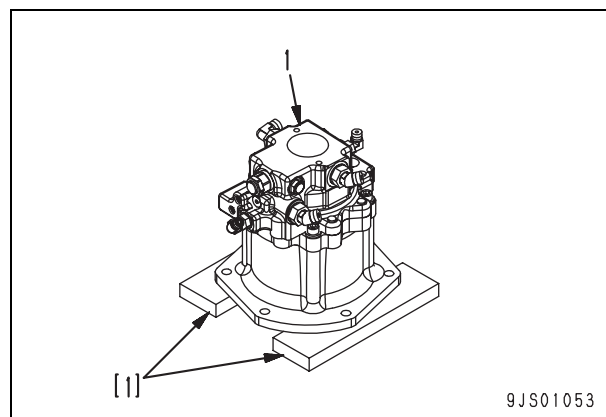
7. Swing motor assembly

Fit the O-ring and install swing motor assembly (1).



Mounting bolt:


59 – 74 Nm {6 – 7.5 kgm}

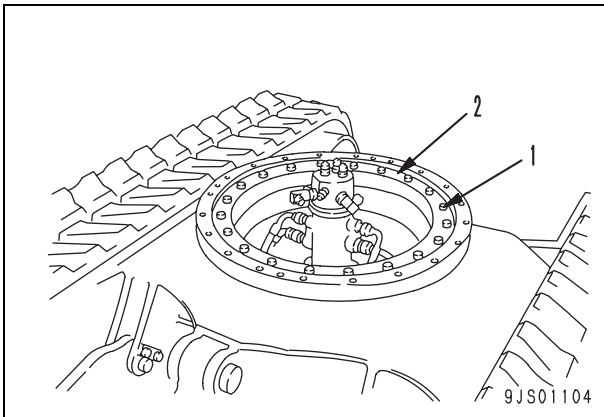


Removal and installation of swing circle assembly

Removal

1. Remove the revolving frame assembly. For details, see "Removal and installation of revolving frame assembly".
2. Remove 20 mounting bolts (1). [^{*1}]
3. Install the hanging bolts and lift off swing circle assembly (2). [^{*2}]


 Swing circle assembly: **40 kg**



Installation


- Carry out installation in the reverse order to removal.

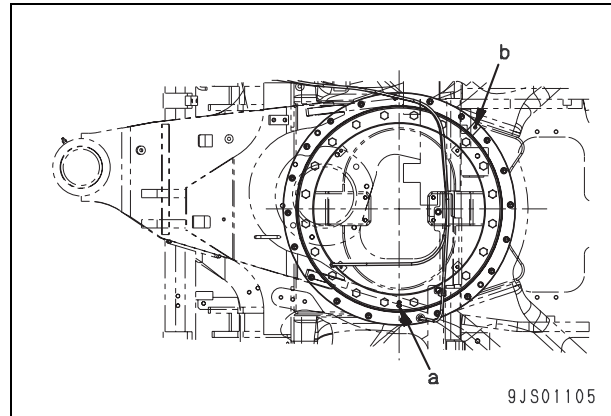
[^{*1}]

 Mounting bolt: **Adhesive (LT-2)**
 Mounting bolt:
117.6 – 137.2 Nm {12 – 14 kgm}
(Target: 127.4 Nm {13 kgm})

[^{*2}]

- ★ When installing the swing circle assembly, set inner race soft zone (a) (mark of S) and outer race soft zone (b) as shown below.

 Inner race tooth surface:
Grease (G2-LI)



PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04388-00

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Printed in Japan 03-08 (01)

HYDRAULIC EXCAVATOR

PC27MR-3
PC30MR-3
PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

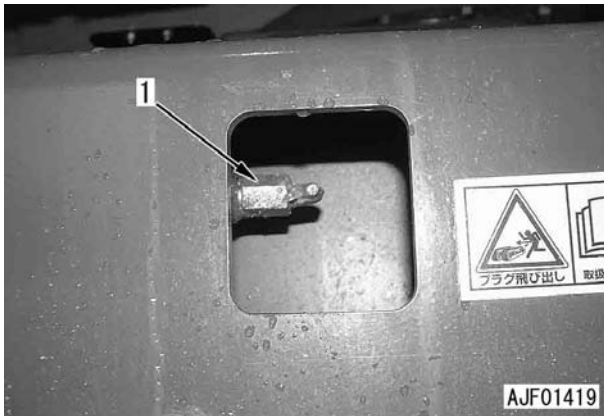
400 Undercarriage and frame

Removal and installation of track shoe assembly	2
Disassembly and assembly of idler assembly	3
Disassembly and assembly of recoil spring assembly	5
Disassembly and assembly of track roller assembly	8
Disassembly and assembly of carrier roller assembly	9
Removal and installation of revolving frame assembly	10

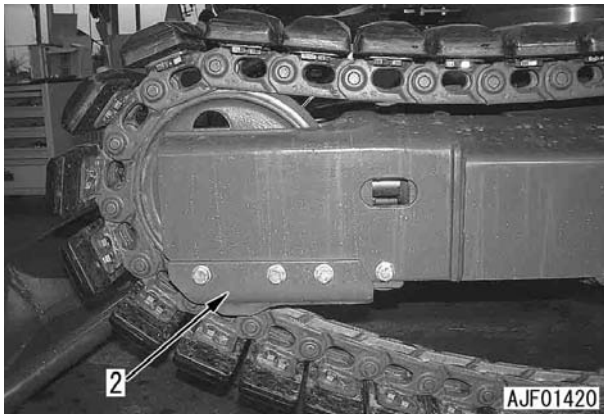
Removal and installation of track shoe assembly

Removal

1. Swing the upper structure by 180° and raise the machine by using the work equipment and blade.
2. Loosen valve (1) to discharge grease and loosen the track shoe tension. [*1]
⚠ Since valve (1) may jump out because of the high-pressure grease, do not loosen it more than 1 turn.



3. Remove cover (2).



4. Sling track shoe assembly (3) and pull it out toward this side.



Rubber shoe

PC27MR-3: **120 kg**

PC30, 35MR-3: **130 kg**

Double grouser shoe

PC27MR-3: **160 kg**

PC30, 35MR-3: **170 kg**

Road liner

PC27MR-3: **180 kg**

PC30, 35MR-3: **190 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ Adjust the track shoe tension. For details, see Testing and adjusting, "Testing and adjusting track shoe tension".

Disassembly and assembly of idler assembly

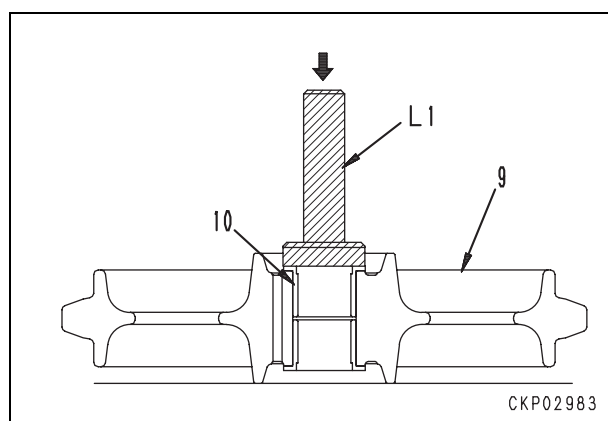
Special tools

Symbol	Part No.	Part name	Necessity	Qty	New/Remodel	Sketch
L	790-101-5001	Push tool KIT	●	1		
	790-101-5081	• Plate		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
2	791-430-3230	Installer	■	1		

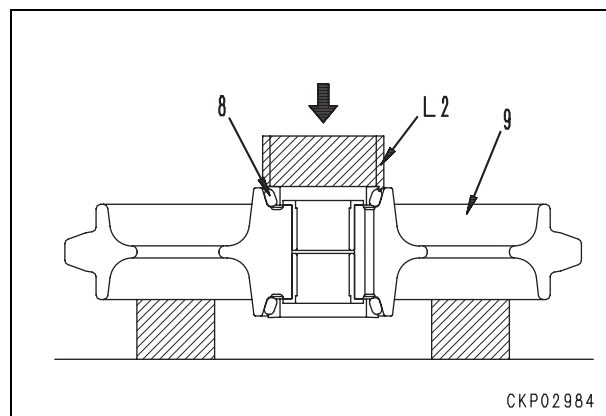
★ In this section, only the assembly procedure is explained.

Assembly

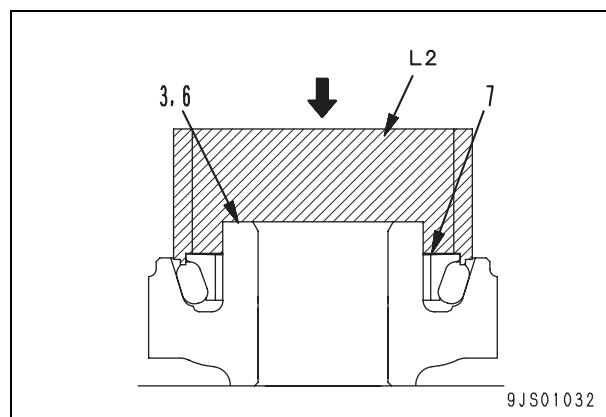
- Using tool **L1**, press fit 2 bushings (10) to idler (9).



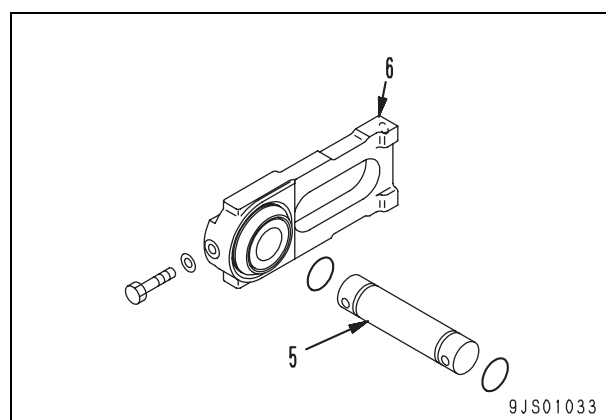
- Using tool **L2**, install 2 floating seals (8) to idler (9).
 - ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.
 - ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.



- Using tool **L2**, install floating seals (7) to supports (3) and (6).
 - ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.
 - ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.



- Fit O-ring and install shaft (5) to support (6).



5. Install support and shaft assembly (4) to idler.

6. Fill inside of idler with engine oil.



Inside portion of idler:

Approx. 20 cc (EO30-CD)

7. Install support (3).



Mounting bolt: **Thread tightener (LT-2)**

8. Install bracket (2).



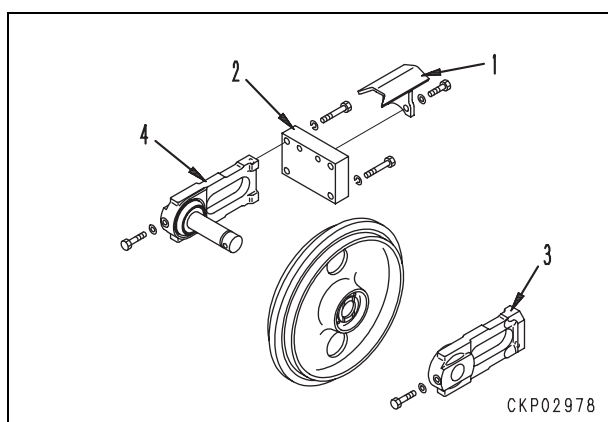
Mounting bolt: **Thread tightener (LT-2)**



Mounting bolt:

98 – 123 Nm {10.0 – 12.5 kgm}

9. Install cover (1).



Disassembly and assembly of recoil spring assembly

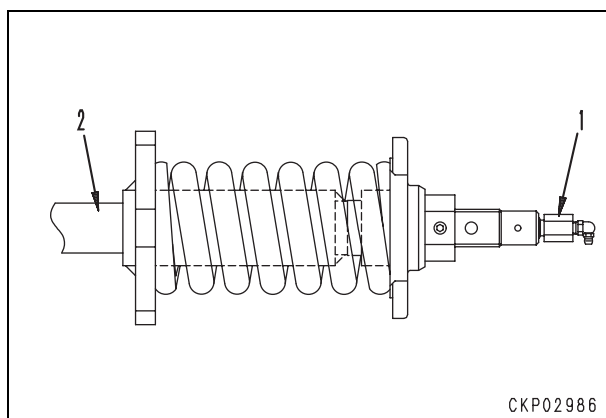
Special tools

Symbol	Part No.	Part name	Necessity	Qty	New/Remodel	Sketch
M	792-371-1400	Sleeve	■	1		

Disassembly

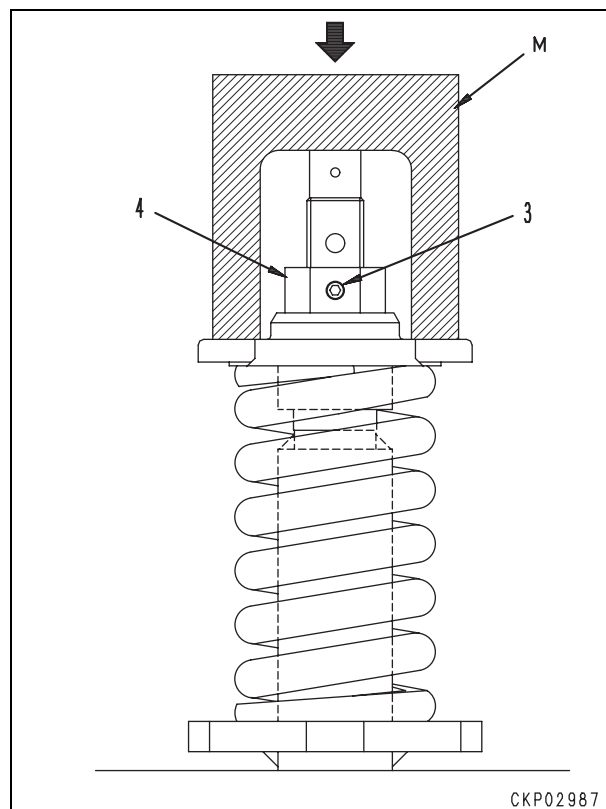
1. Piston

- 1) Remove valve (1).
- 2) Remove piston (2).



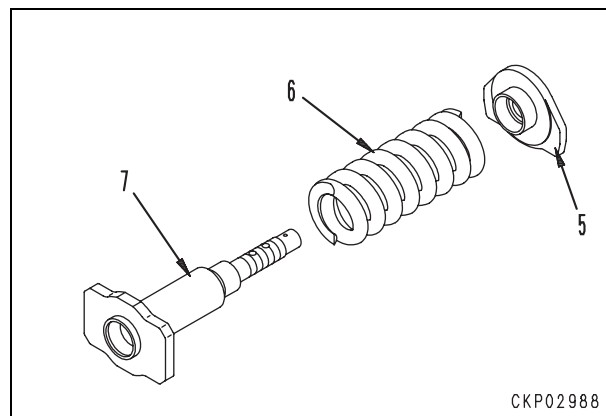
2. Recoil spring

- 1) Using tool M, set recoil spring to press.
 - ⚠ **The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.**
- 2) Apply hydraulic pressure slowly to compress spring, then remove screw (3) and remove nut (4).
 - ★ Compress the spring to a point where the nut becomes loose.
 - ★ Installed load of spring:
30.9 kN {3,153 kgm}



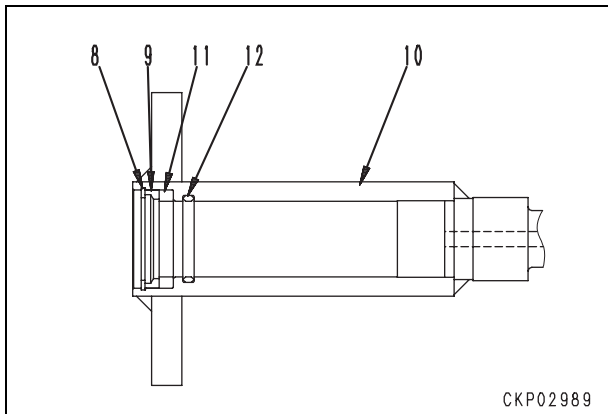
- 3) Release the hydraulic pressure slowly and allow spring to extend, then remove stopper (5) and spring (6) from cylinder assembly (7).

★ Free length of spring: 257 mm

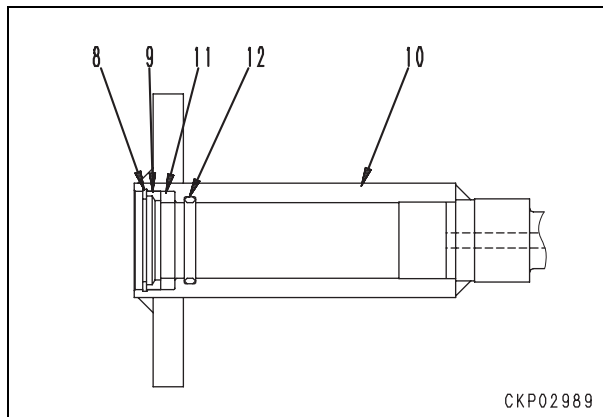


3. Cylinder

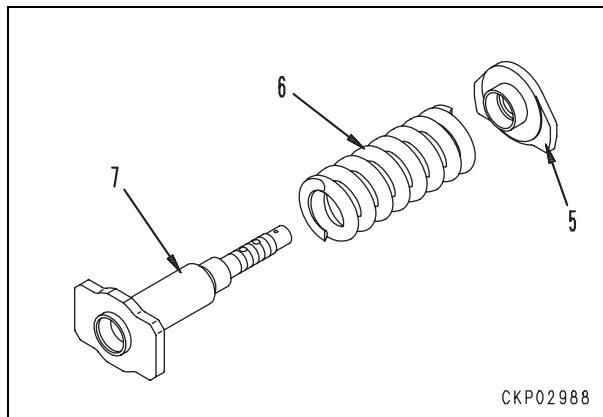
- 1) Remove snap ring (8), then remove spacer (9) from cylinder (10).
- 2) Remove dust seal (11).
- 3) Remove O-ring (12).

**Assembly****1. Cylinder**

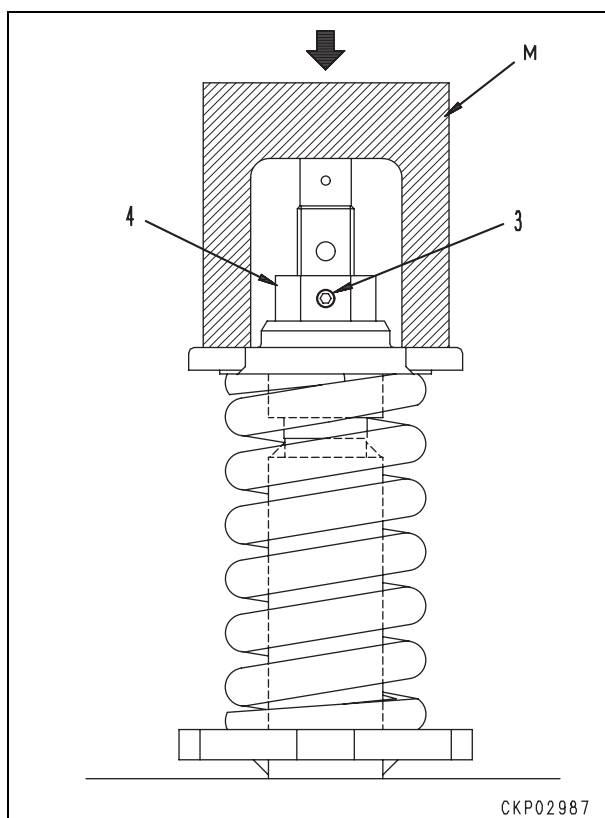
- 1) Install O-ring (12) to cylinder (10).
- 2) Install dust seal (11).
- 3) Fit spacer (9) and secure with snap ring (8).

**2. Recoil spring**

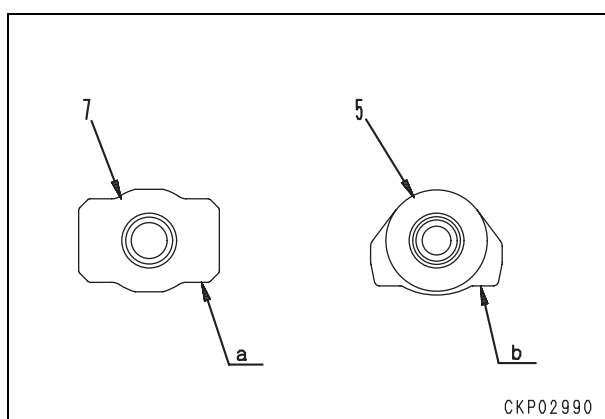
- 1) Assemble cylinder assembly (7), spring (6), and stopper (5).



- 2) Using tool **M**, set recoil spring to press.
⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.
- 3) Apply hydraulic pressure slowly to compress spring, then fit nut (4) and install screw (3).
 ★ Installed height of spring:
 Rubber shoe specification: 188 mm
 Steel, road liner specification: 213 mm

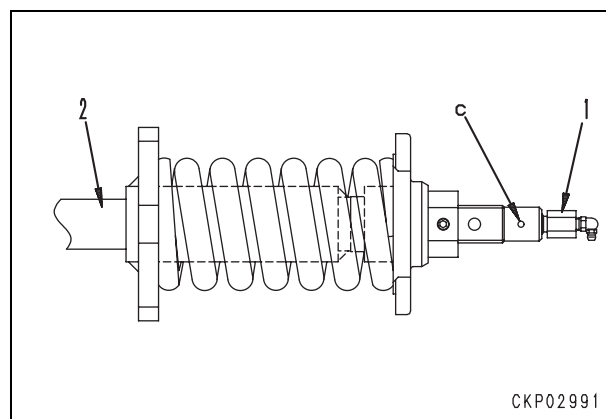


- ★ After assembling the recoil spring, check that the out-of-parallel between surface (a) of cylinder (7) and surface (b) of stopper (5) is less than 0.5 mm.
- ★ The figure shows PC30, 35MR-3 as an example.



3. Piston

- 1) Tighten plug (1) temporarily.
 ★ Grease will come out from grease hole (c), so tighten completely, then turn back approx. 2 turns.
- 2) Add approx. 120 cc of grease (G2-LI) inside cylinder.
- 3) Assemble cylinder (2) and push in until grease comes out from grease hole (c).
- 4) When grease comes out, tighten valve (1).
 ★ After tightening the valve, check that the grease fitting is facing the outside (just beside) of the chassis.



Disassembly and assembly of track roller assembly

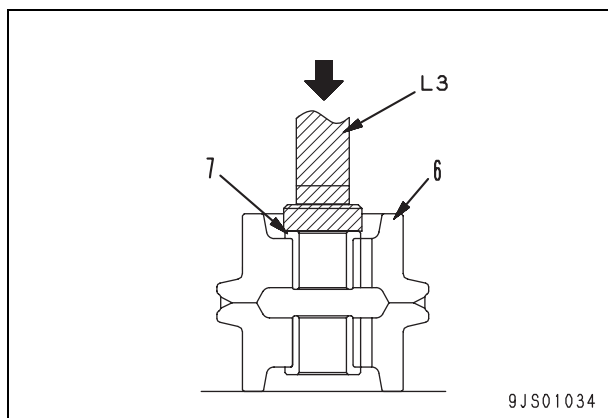
Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L 3	790-101-5001	Push tool KIT	●	1		
	790-101-5051	• Plate		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
4	791-434-1660	Installer	■	1		

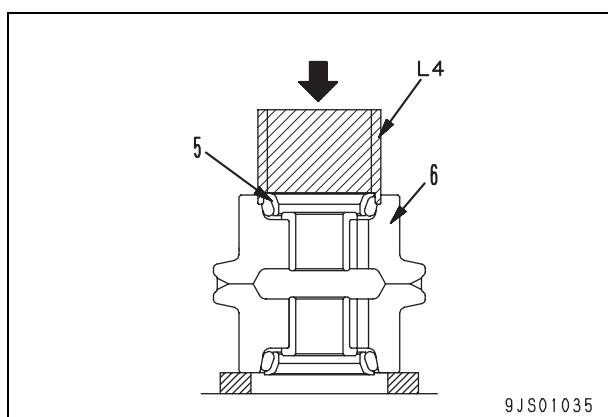
★ In this section, only the assembly procedure is explained.

Assembly

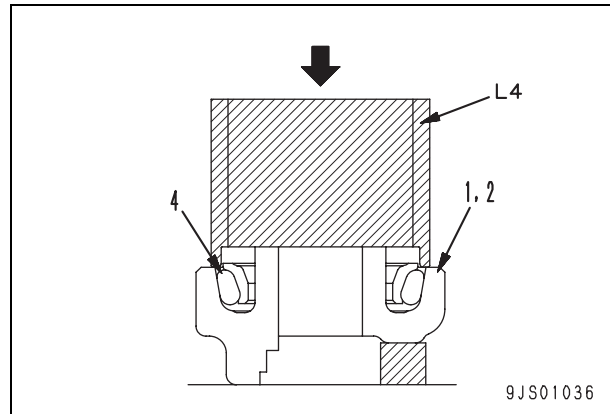
- Press fit two pieces of bushing (7) in roller (6) using tool **L3**.



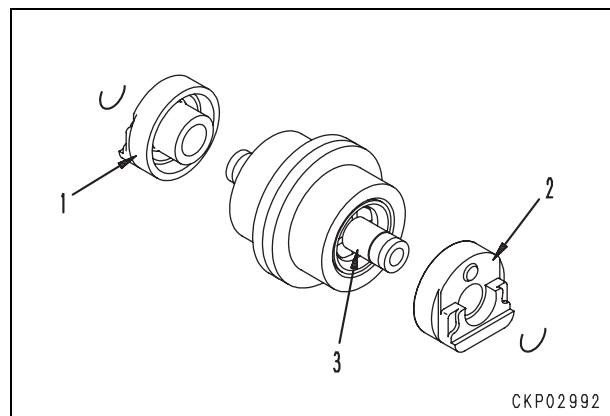
- Set two pieces of floating seal (5) in roller (6) using tool **L4**.
 - ★ Clean the O-ring and the O-ring contact surface to degrease completely and dry them.
 - ★ Apply engine oil (EO30-CD) to the floating seal sliding surface and keep it free from dust.



- Set floating seal (4) in collars (1) and (2) by using tool **L4**.
 - ★ Clean the O-ring and the O-ring contact surface to degrease completely and dry them.
 - ★ Apply engine oil (EO30-CD) to the floating seal sliding surface and keep it free from dust.



- Set the O-ring and install shaft (3) in the roller.
- Set collar (2) on the roller and fix it with a snap ring.
- Fill engine oil in the roller.
 - Roller inside: **Approx. 50cc (EO30-CD)**
- Set collar (1) on the roller and fix it with a snap ring.



Disassembly and assembly of carrier roller assembly

Special tools

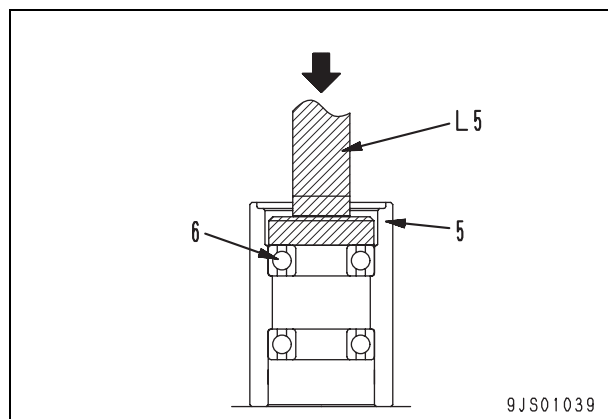
Symbol	Part No.	Part name	Necessity	Qty	New/Remodel	Sketch
L5	790-101-5001	Push tool KIT	●	1		
	790-101-5081	• Plate		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
L6	790-101-5001	Push tool KIT	●	1		
	790-101-5111	• Plate		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		

★ In this section, only the assembly procedure is explained.

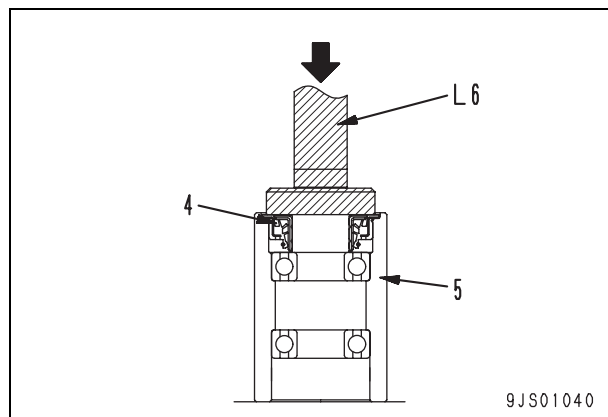
Assembly

- Using tool **L5**, press fit 2 ball bearings (6) to roller (5).

Fill the ball portion of the bearing with grease (**G2-LI**).



- Using tool **L6**, press fit dust seal (4) to roller (5).



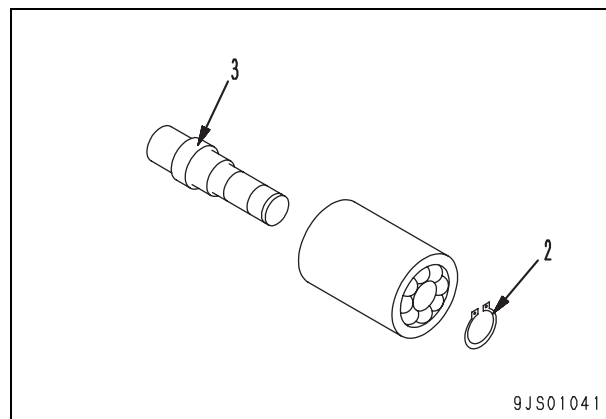
- Fill the inside of the roller with grease.



Inside portion of roller:

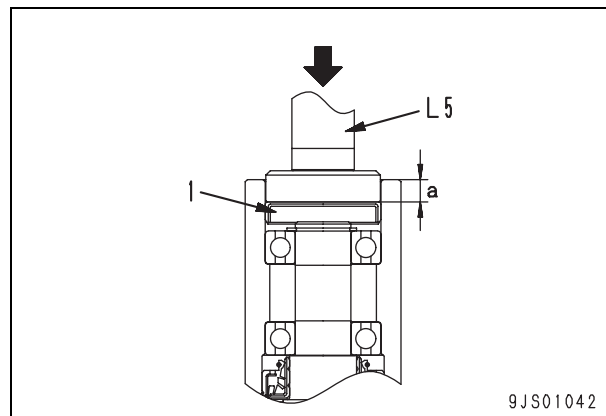
Approx. 30 cc (G2-LI)

- Install shaft (3) to roller.
- Using snap ring pliers, install snap ring (2).
★ Install the snap ring so that the edge on the inside faces the tip of the shaft.



- Using tool **L5**, press fit cap (1).

★ Cap press-fitting depth (a): 10 mm

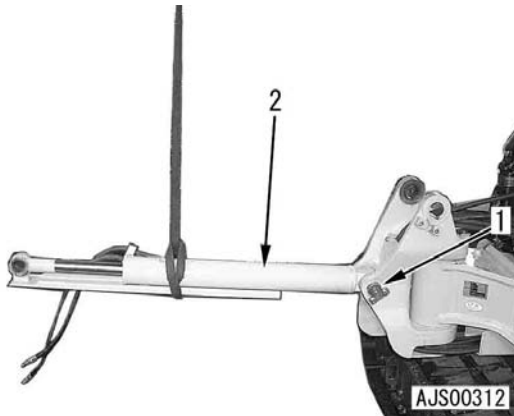


Removal and installation of revolving frame assembly

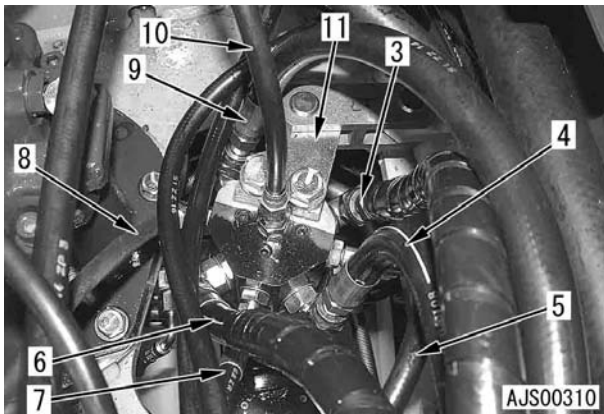
Removal

1. Remove the work equipment. For details, see "Removal and installation of work equipment assembly".
2. Remove the canopy and floor frame (operator's cab and floor frame) assembly. For details, see "Removal and installation of floor frame assembly".
3. Pull out pin (1) and remove boom cylinder assembly (2). [^{*1}]

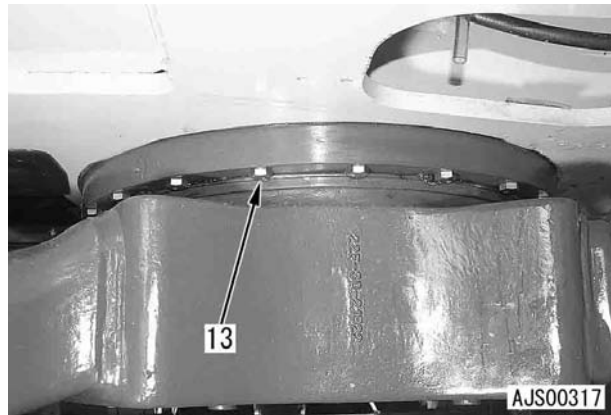
 Boom cylinder: **30 kg**




4. Disconnect the hoses from the center swivel joint and remove the lever. [^{*2}]
- Hoses (3) – (10) and lever (11)



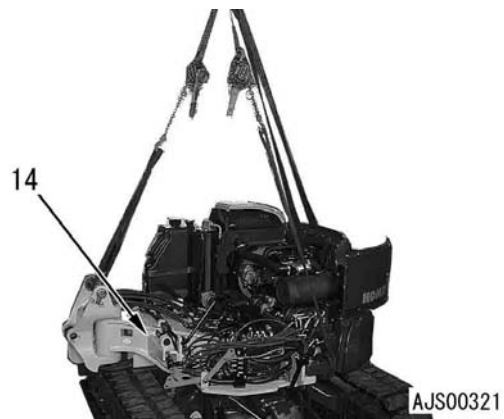
5. Sling the revolving frame assembly temporarily and remove mounting bolts (13). [^{*3}]
- ★ Leave 2 bolts each on the front and rear sides.



6. Remove the remaining mounting bolts and lift off revolving frame assembly (14).
- ★ Balancing the revolving frame assembly with lever blocks, etc., remove the remaining mounting bolts.
 - ★ When removing the revolving frame assembly, check that all the pipes have been disconnected and take care not to damage the center swivel joint.

 Revolving frame assembly


PC27MR-3: **1,200 kg**
PC30MR-3: **1,300 kg**
PC35MR-3: **1,550 kg**




Installation


- Carry out installation in the reverse order to removal.

[*1]

 **When aligning the pin holes, never insert your fingers in them.**


 Sliding surfaces of pin and swing bracket:


Molybdenum disulfide grease (LM-P)

 Greasing after installation:

Grease (Hyper white grease)


[*2]


 Lever mounting bolt: **Adhesive (LT-2)**

 Lever mounting bolt:

153 – 190 Nm {15.5 – 19.5 kgm}

[*3]

 Revolving frame assembly mounting bolt: **Adhesive (LT-2)**

 Revolving frame assembly mounting bolt: **117.6 – 137.2 Nm {12 – 14 kgm}**

- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, “Bleeding air from each part”.

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

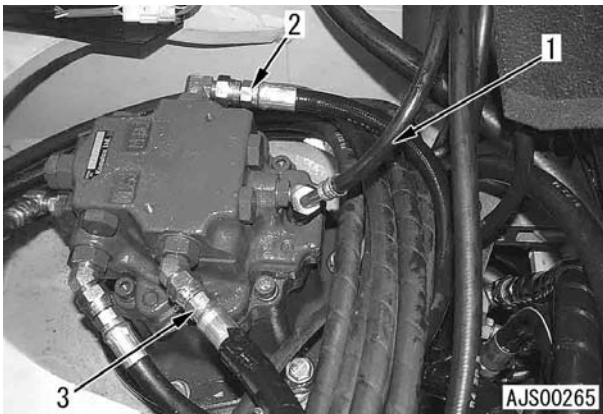
500 Hydraulic system

Removal and installation of center swivel joint assembly	2
Disassembly and assembly of center swivel joint assembly	4
Disassembly and assembly of control valve assembly	6
Disassembly and assembly of hydraulic cylinder assembly	7

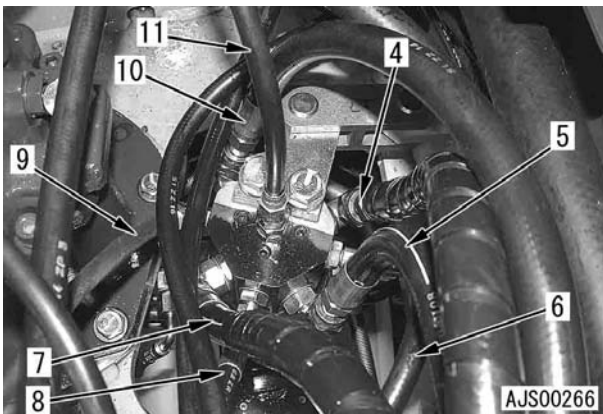
Removal and installation of center swivel joint assembly

Removal

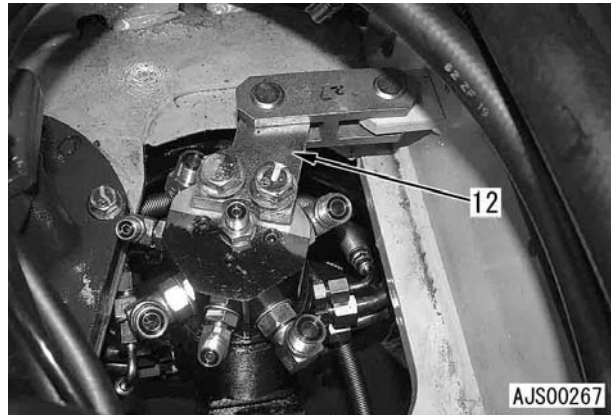
1. Release the air pressure in the hydraulic tank.
For details, see Testing and adjusting, "Releasing air in hydraulic tank".
2. Tilt up the floor frame.
For details, see Testing and adjusting, "How to open and close (tilt) floor".
3. Disconnect hoses (1), (2), and (3) from the swing motor. Move the hoses above the center swivel joint together toward the swing motor.



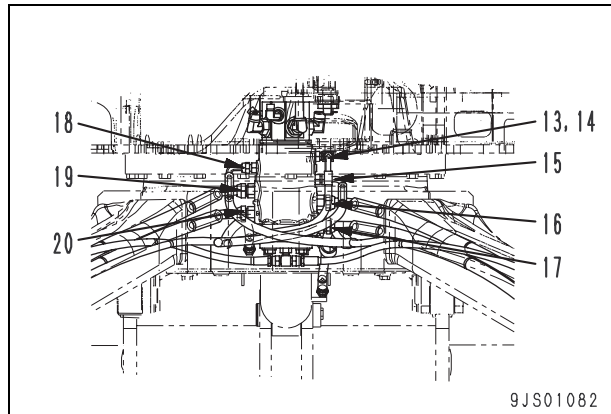
4. Disconnect hoses (4) – (11).



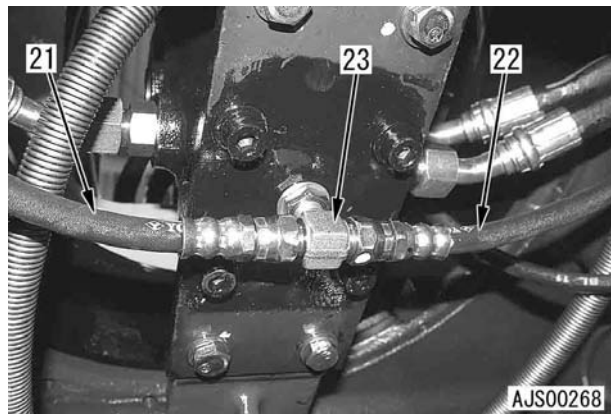
5. Remove lever (12) from the center swivel joint.
[*1]



6. Disconnect hoses (13) – (20).



7. Disconnect hoses (21) and (22) and remove elbow (23).



8. Remove center swivel joint assembly (24).



Installation

- Carry out installation in the reverse order to removal.

[*1]

- Lever mounting bolt: **Adhesive (LT-2)**
- Lever mounting bolt:
153 – 190 Nm {15.5 – 19.5 kgm}

- **Refilling with oil (Hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

- **Bleeding air**

- ★ Bleed air. For details, see Testing and adjusting, “Bleeding air from each part”.

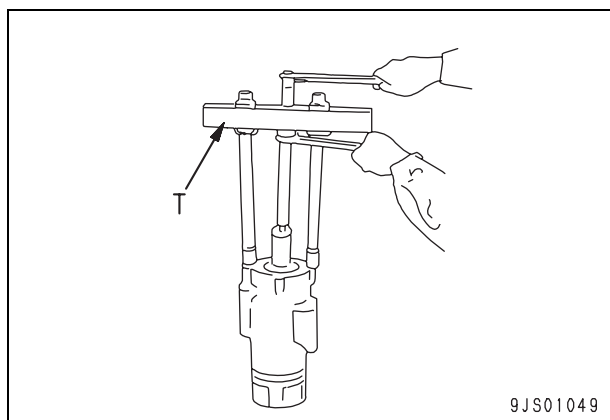
Disassembly and assembly of center swivel joint assembly

Special tools

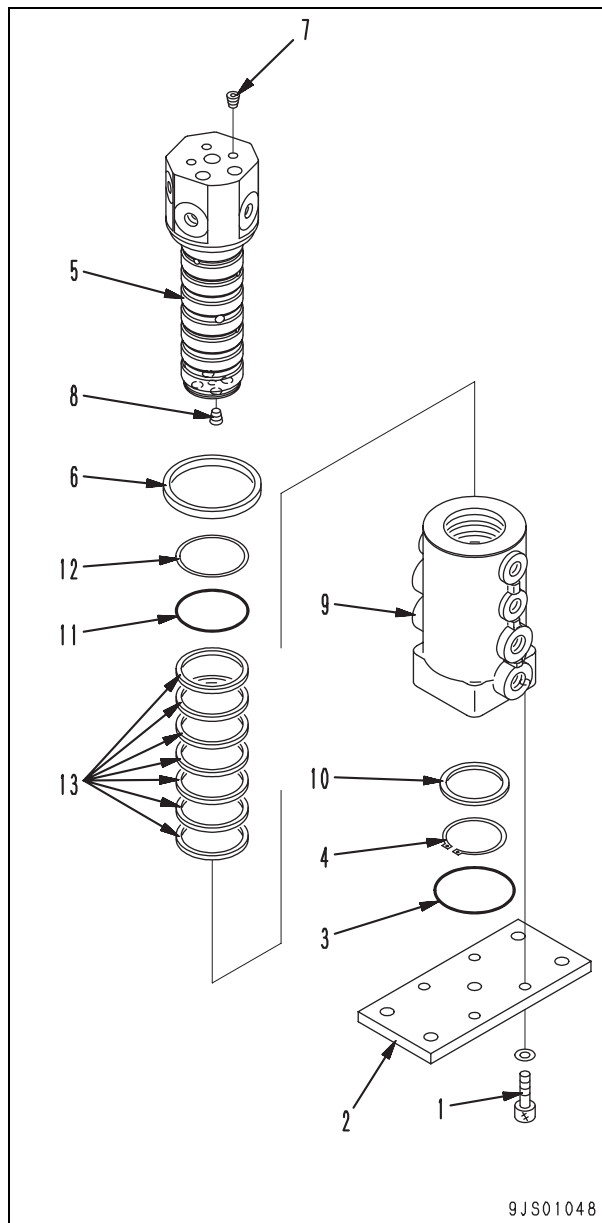
Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
T	790-101-2501	Push puller	●	1		
	790-101-2510	• Block		1		
	790-101-2520	• Screw		1		
	791-112-1180	• Nut		1		
	790-101-2540	• Washer		1		
	790-101-2630	• Leg		2		
	790-101-2570	• Plate		4		
	790-101-2560	• Nut		2		
	790-101-2660	• Adapter		2		

Disassembly





1. Remove bolts (1) and plate (2).
2. Remove O-ring (3) and snap ring (4).
3. Using tool T, pull rotor (9) out of swivel shaft (5)

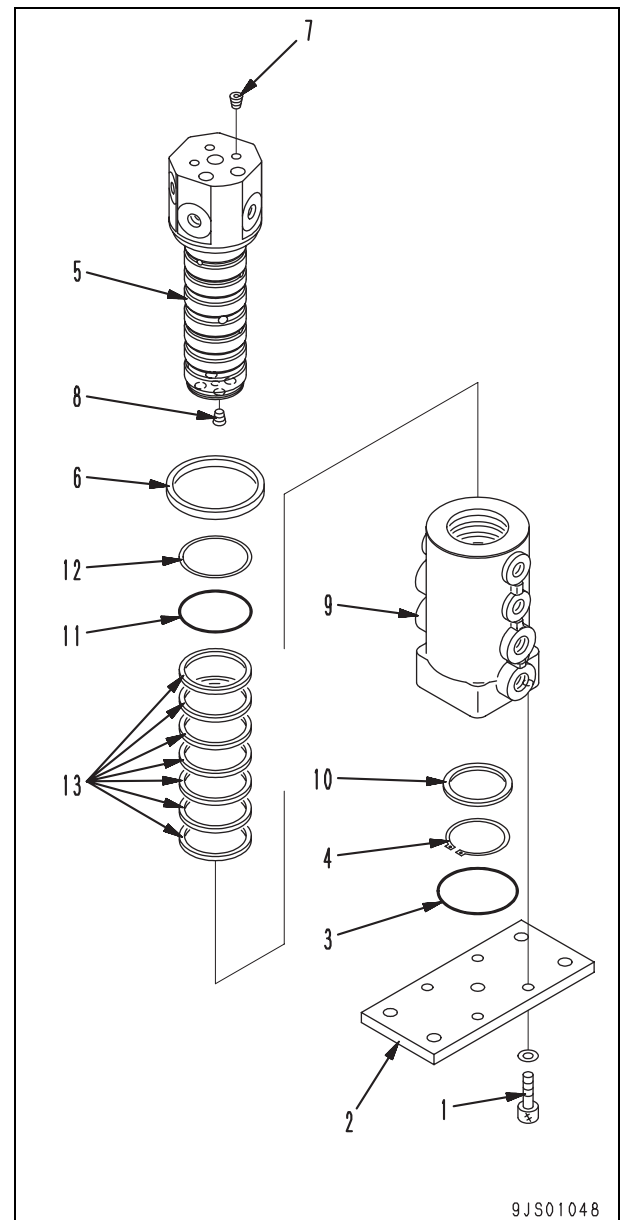


4. Remove dust seal (6), 3 plugs (7), and 4 plugs (8) from swivel shaft (5).
5. Remove ring (10), O-ring (11), backup ring (12), and 7 slipper seals (13) from rotor (9).



Assembly

1. Install O-ring (11), backup ring (12), and 7 slipper seals (13) to rotor (9).
2. Install dust seal (6) to swivel shaft (5).
 Dust seal lip: **Grease (G2-LI)**
3. Install 3 plugs (7) and 4 plugs (8) to swivel shaft (5).
 - ★ Degrease, clean, and dry the threaded parts sufficiently.
 - ★ After installing, check that the plug ends are lower than the shaft end. Plug (8)
 PC27MR-3:
 $16.7 \pm 2.9 \text{ Nm}$ { $1.7 \pm 0.3 \text{ kgm}$ }
 PC30, 35MR-3:
 $33.3 \pm 3.9 \text{ Nm}$ { $3.4 \pm 0.4 \text{ kgm}$ }
4. Set swivel shaft (5) to the block. Using the push tool and hitting with a plastic hammer, etc., install rotor (9).
 - ★ Take care extremely not to damage the slipper seals and O-ring. Contact surfaces of rotor and swivel shaft: **Grease (G2-LI)**
5. Install ring (10), snap ring (4), and O-ring (3).
6. Install plate (2).
 -  Mounting bolt (1)
 PC27MR-3:
 $11.8 - 14.7 \text{ Nm}$ { $1.2 - 1.5 \text{ kgm}$ }
 PC30, 35MR-3:
 $66 \pm 7 \text{ Nm}$ { $6.7 \pm 0.7 \text{ kgm}$ }



9JS01048

Disassembly and assembly of control valve assembly

In this section, only the precautions for assembling the control valve assembly are explained.

- ★ Work in a clean indoor place where there is no dirt and dust.
- ★ Clean the parts in clear solvent, and then dry them with compressed air.
- ★ Replace a part having burrs with new one.
- ★ Coat the sliding surfaces of each part with engine oil before installing.
- ★ Take care of the installed direction of each spool.
- ★ When tightening the plug of each spool, apply a drop (about 0.02 g) of LOCTITE (No. 638) or equivalent to it.
- ★ Apply Sealend 242 or equivalent to the mating faces.
- ★ For tightening torque of each part, see Structure, function and maintenance standard, "Control valve".

Disassembly and assembly of hydraulic cylinder assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
1	790-502-1003	Cylinder repair stand	■	1		
	790-101-1102	Hydraulic pump	■	1		
2	790-330-1100	Wrench assembly	■	1		
3	Commercially available	Socket (Width across flats: 41 mm)	■	1		
	Commercially available	Socket (Width across flats: 46 mm)	■	1		
	790-302-1390	Socket (Width across flats: 46 mm, long type)	■	1		
	790-302-1270	Socket (Width across flats: 50 mm)	■	1		
	790-302-1490	Socket (Width across flats: 50 mm, long type)	■	1		
	790-302-1280	Socket (Width across flats: 55 mm)	■	1		
	790-302-1470	Socket (Width across flats: 55 mm, long type)	■	1		
	790-201-1702	Push tool KIT	■	1		
4	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
	790-201-1731	• Push tool		1		
	790-201-1751	• Push tool		1		
	790-201-1741	• Push tool		1		
	790-201-1761	• Push tool		1		
	790-201-1500	Push tool KIT	■	1		
5	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
	790-201-1540	• Plate		1		
	790-201-1560	• Plate		1		
	790-201-1550	• Plate		1		
	790-201-1570	• Plate		1		
	790-201-1570	• Plate		1		
6	790-720-1000	Expander	●	1		
7	796-720-1630	Ring	●	1		
	07281-00709	Clamp	●	1		
	796-720-1640	Ring	●	1		
	07281-00909	Clamp	●	1		
	796-720-1740	Ring	●	1		
	07281-00809	Clamp	●	1		
	796-720-1650	Ring	●	1		
	07281-01029	Clamp	●	1		

- ★ In this section, only the assembly procedure is explained.

Assembly

- ★ The contents of this section are common to all the cylinders, unless otherwise specified.
- ★ Take care not to damage the packings, dust seals, O-rings, etc.
- ★ Clean each part thoroughly. After assembling, close the piping ports and pin inserting holes so that dirt will not enter them.
- ★ Do not insert each backup ring forcibly, but warm it in water at 50 – 60°C and then insert it.

1. Cylinder

- 1) Fit the O-ring and install elbow (25) to cylinder (3).

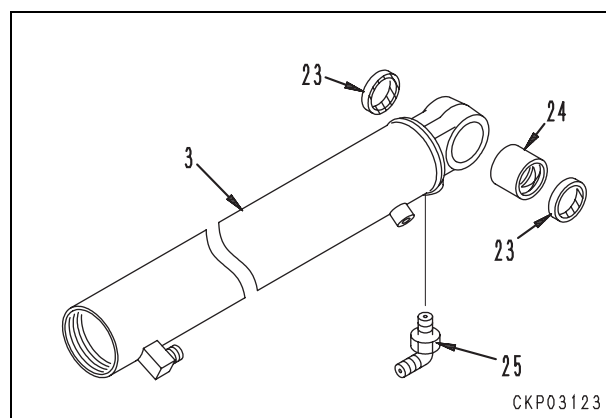
- ★ Perform this step for only the arm cylinder of PC35MR-3.

Elbow

PC35MR-3:

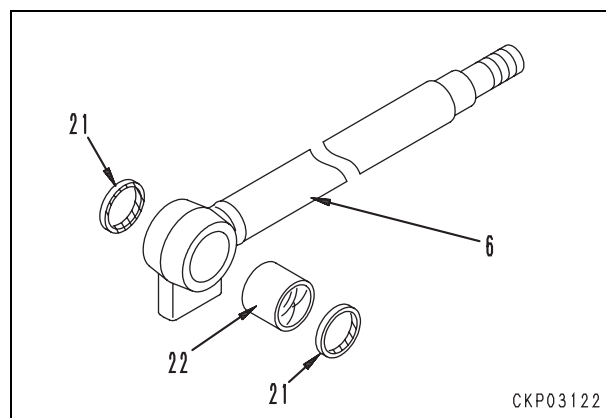
84 – 132 Nm {8.5 – 13.5 kgm}

- 2) Press fit bushing (24).
- 3) Press fit 2 dust seals (23).



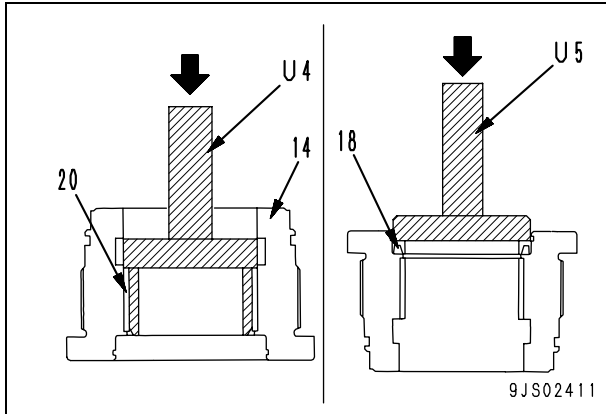
2. Piston rod

- 1) Press fit bushing (22) to piston rod (6).
- 2) Press fit 2 dust seals (21).

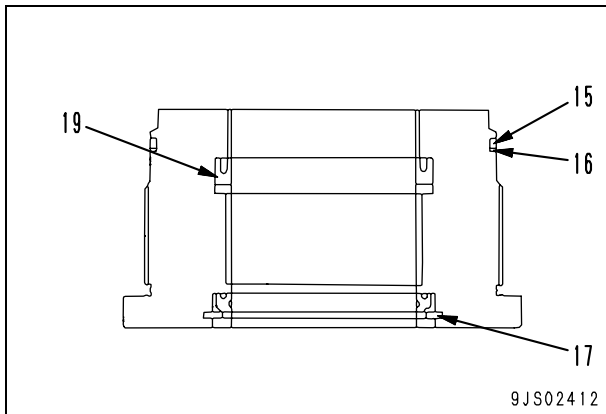


3. Cylinder head assembly

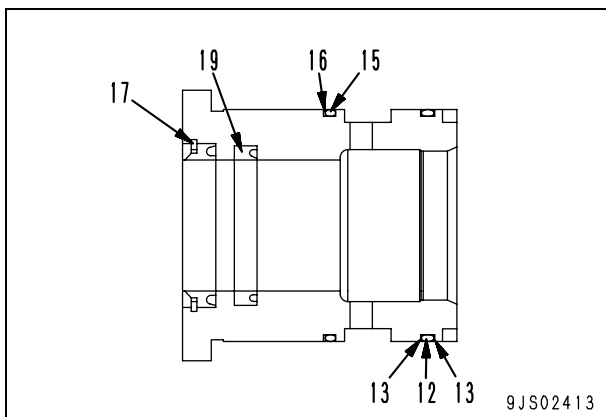
- 1) Using tool **U4**, press fit bushing (20) to cylinder head (14).
★ Except boom cylinder
- 2) Using tool **U5**, press fit dust seal (18).



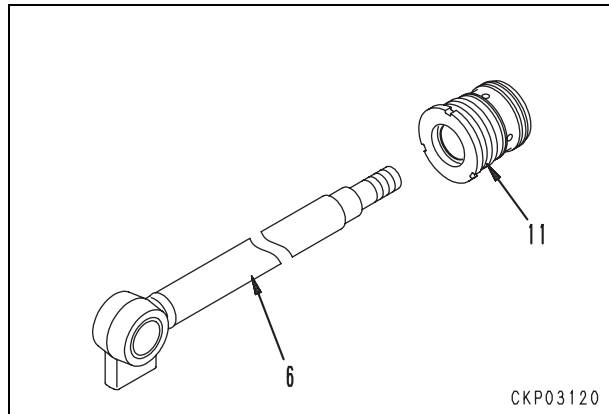
- 3) Using snap ring pliers, install snap ring (17).
- 4) Install rod packing (19).
- 5) Install O-ring (15) and backup ring (16).



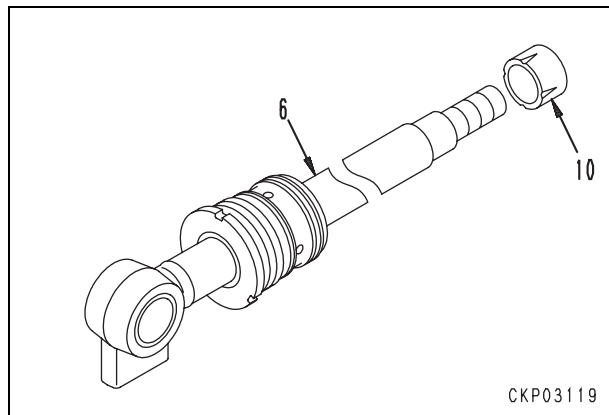
- 6) Install O-ring (12) and 2 backup rings (13).
★ Boom cylinder only



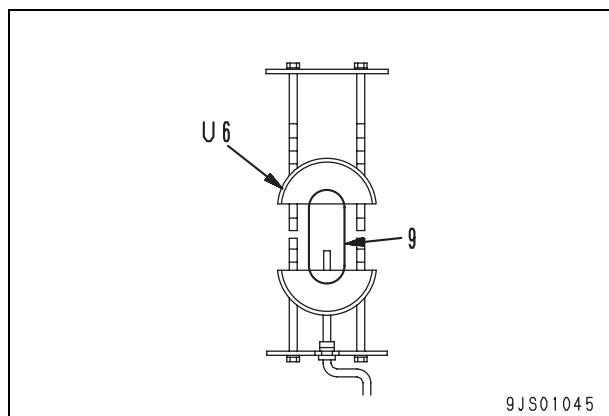
- 7) Fit O-ring and install cylinder head assembly (11) to piston rod (6).

**4. Piston assembly**

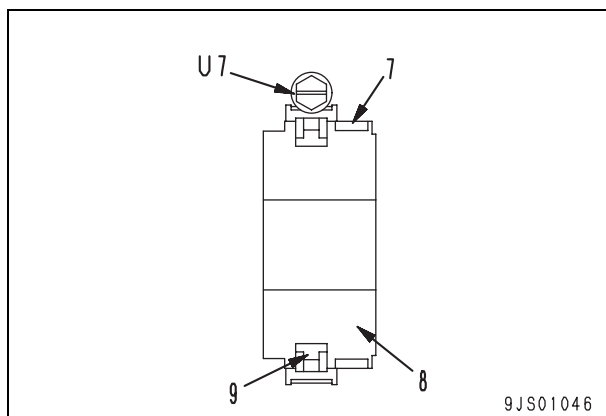
- 1) Install cushion plunger (10) to piston rod (6).
★ Boom cylinder only



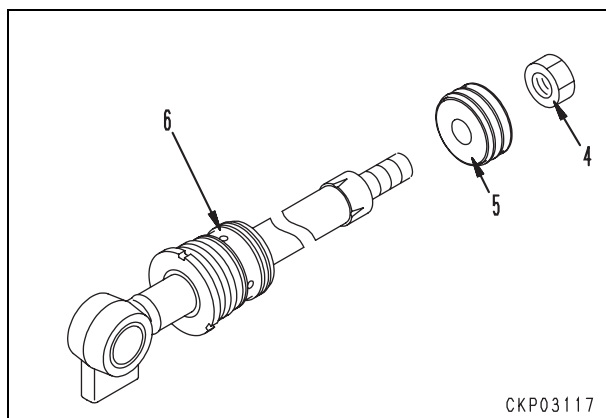
- 2) Set the piston ring (9) on tool **U6** and turn the handle 8 to 10 times to expand the ring.



- 3) Install piston ring (9) to piston (8).
- 4) Using tool **U7**, compress piston ring (9).
- 5) Install wear ring (7).



- 6) Install piston assembly (5) to piston rod (6).



- 7) Set piston rod assembly (2) to tool **U1**.
- 8) Using tool **U3**, install piston nut (4).

★ Width across flats of piston nut:

(Unit: mm)

Model	Boom	Arm	Bucket	Swing
PC27MR	46	46	41	41
PC30MR	46	50(*)	46	41
PC35MR	46	50(*)	46	55

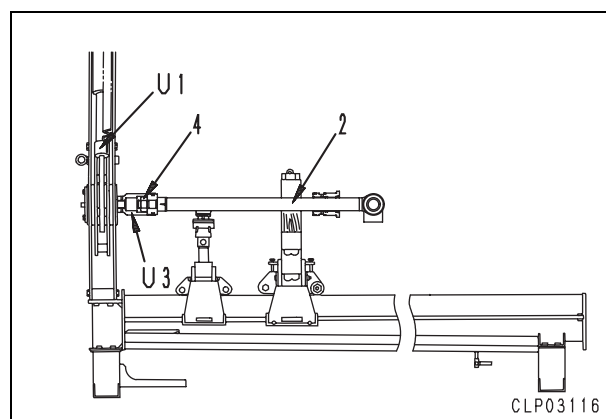
★ Use long-type sockets for the nuts marked with *.

 Piston nut: **Thread tightener (Loctite 262 or equivalent)**

 Piston nut:

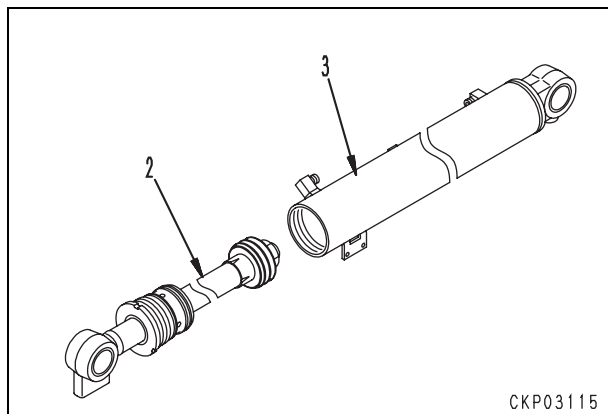
(Unit: Nm {kgm})

Model	Boom	Arm	Bucket
PC27MR	912 ± 91.0 {93 ± 9.3}	912 ± 91.0 {93 ± 9.3}	618 ± 62.0 {63 ± 6.3}
PC30MR	912 ± 91.0 {93 ± 9.3}	1245 ± 124.5 {127 ± 12.7}	785 ± 78.5 {80 ± 8.0}
PC35MR	912 ± 91.0 {93 ± 9.3}	1245 ± 124.5 {127 ± 12.7}	785 ± 78.5 {80 ± 8.0}




5. Piston rod assembly

- 1) Install piston rod assembly (2) to cylinder (3).

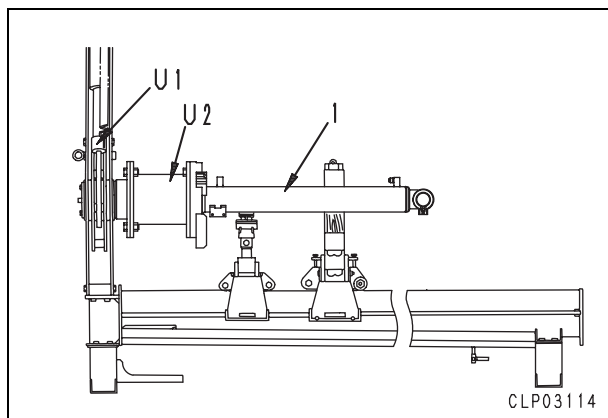


- 2) Set cylinder assembly (1) to tool **U1**.
- 3) Using tool **U2**, tighten cylinder head.


 Cylinder head:

(Unit: Nm {kgm})

Model	Boom	Arm	Bucket
PC27MR	569 ± 57 {58 ± 5.8}	833 ± 83 {85 ± 8.5}	569 ± 57.0 {58 ± 5.8}
PC30MR	588 ± 59 {60 ± 6.0}	785 ± 78.5 {80 ± 8.0}	677 ± 67.5 {69 ± 6.9}
PC35MR	588 ± 59 {60 ± 6.0}	785 ± 78.5 {80 ± 8.0}	677 ± 67.5 {69 ± 6.9}

**6. Piping**

Install cylinder piping.

 Sleeve nut of bucket cylinder:

46.1 – 61.8 Nm {4.7 – 6.3 kgm}

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
---------------	---------------

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

600 Work equipment

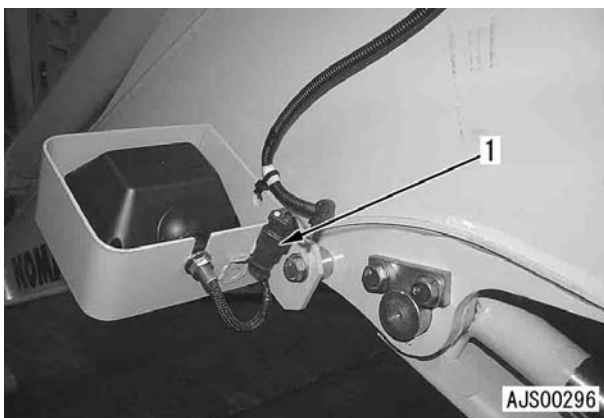
Removal and installation of work equipment assembly	2
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Removal and installation of work equipment assembly

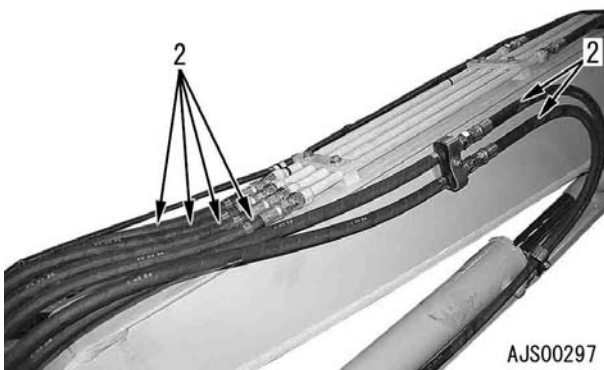
- ⚠ Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Releasing residual pressure in hydraulic circuit."
- ⚠ Extend the boom cylinder and bucket cylinder to the stroke end and lower the work equipment to the ground.
- ⚠ Set the work equipment lock lever in the LOCK position.

Removal

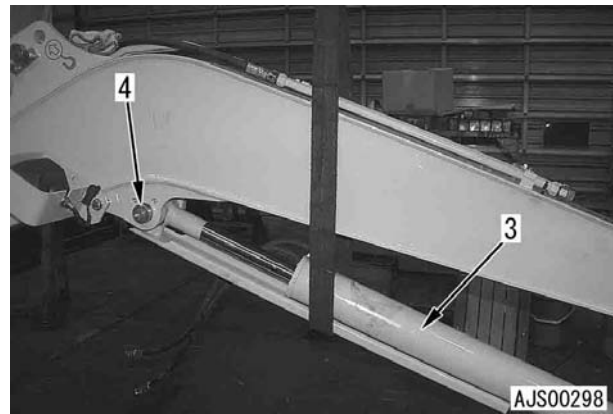
1. Disconnect connector (1) and remove the wiring harness from the boom.



2. Disconnect 6 hoses (2).



3. Sling boom cylinder (3) temporarily and remove the plate and head-side pin (4). [*1]
★ Lower the boom cylinder onto a block, etc.



4. Sling the work equipment assembly temporarily.

5. Remove boom foot pin (5). [*2]



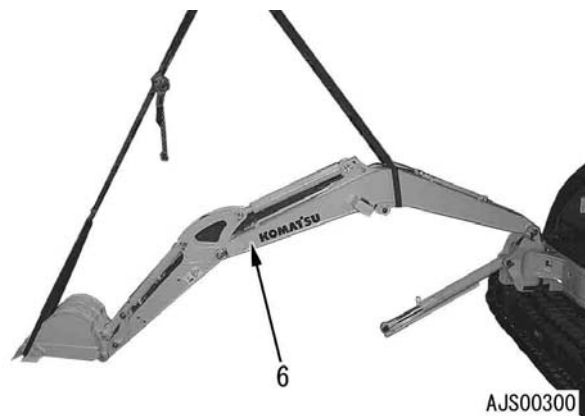
6. Lift off work equipment assembly (6).

 Work equipment assembly

PC27MR-3: 280 kg

PC30MR-3: 310 kg


PC35MR-3: 350 kg




Installation


- Carry out installation in the reverse order to removal.

[*1]

 **When aligning the pin holes, never insert your fingers in them.**


 Sliding surfaces of pin and boom:


Molybdenum disulfide grease (LM-G)

 Greasing after installation:


Grease (Hyper white grease)

[*2]

 **When aligning the pin holes, never insert your fingers in them.**

 Sliding surfaces of pin and swing bracket:

Molybdenum disulfide grease (LM-G)

 Greasing after installation:

Grease (Hyper white grease)

- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

Form No. SEN04391-00

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Printed in Japan 03-08 (01)

HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

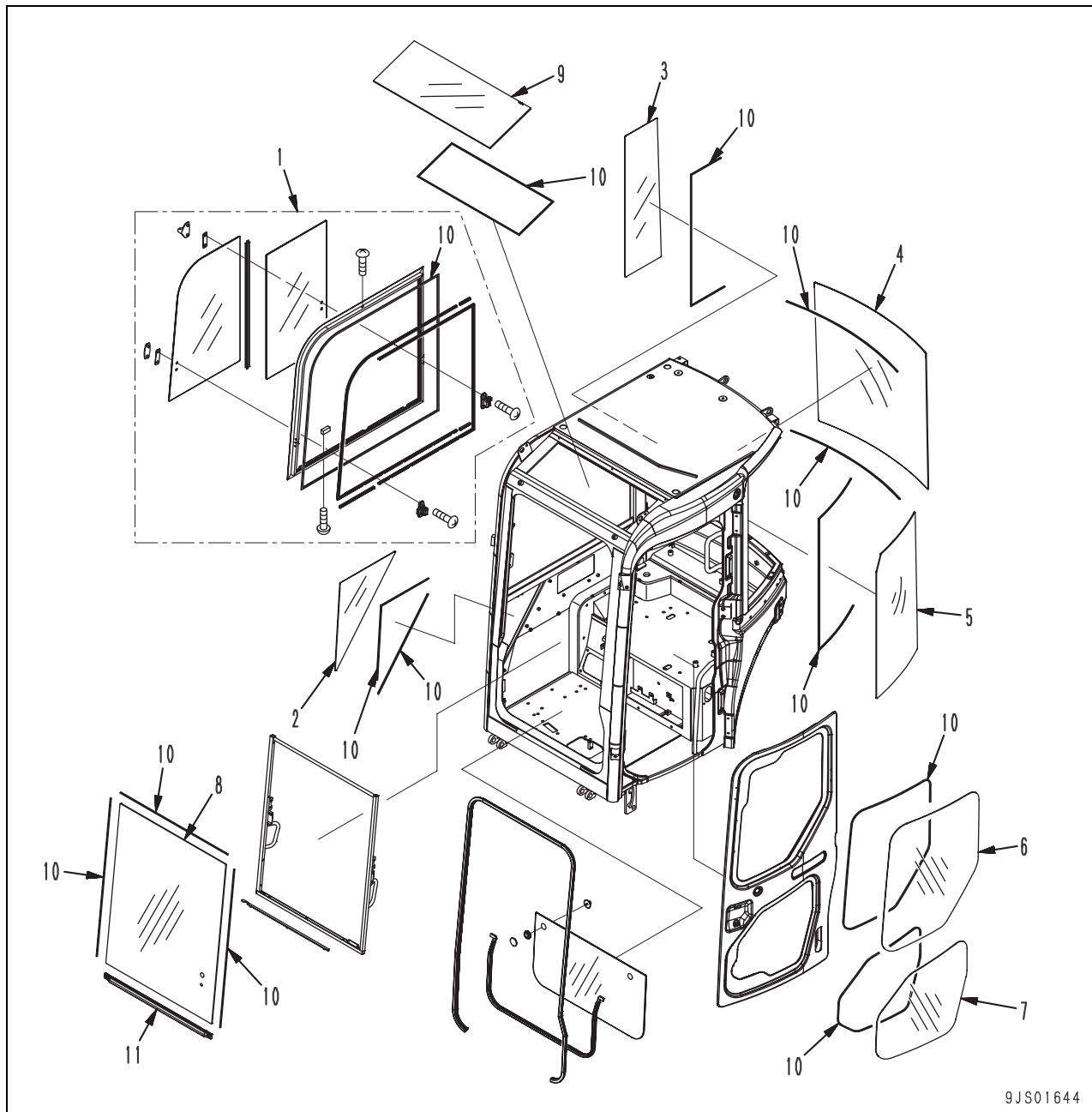
Machine model	Serial number
---------------	---------------

PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

700 Cab and its attachments

Removal and installation of operator's cab glass (stuck glass)	2
Removal and installation of front window assembly	11
Removal and installation of floor frame assembly	12

Removal and installation of operator's cab glass (stuck glass)

9JS01644

- ★ On the 5 faces of the operator's cab, including the ceiling, panes (1) – (9) are stuck. (Ceiling (9) is a clear plate.)
 - ★ When replacing front window glass (8), remove front window assembly. (It is impossible to replace only the front window glass while the front window assembly is installed to the operator's cab.)
 - ★ For the procedure for replacing the front window assembly, see "Removal and installation of front window assembly".
- (1) Right sash window glass assembly
 - (2) Right front lower triangular window glass
 - (3) Right rear window glass
 - (4) Rear window glass
 - (5) Left rear window glass
 - (6) Door upper window glass
 - (7) Door lower window glass
 - (8) Front window glass
 - (9) Clear plate
 - (10) Double-sided adhesive tape
 - (11) Center trim seal

★ Precautions for removing and installing glass

- When removing and installing the glass, be sure to put on protective goggles.
- When using primer or degreasing solvent, take care of fire and ventilation extremely.
- If a shock is given to an edge of the glass, the glass is broken easily. Handle the glass with care.
- If primer, caulking material, or adhesive gets in your eye, wash your eye with much water, and then consult an eye doctor.

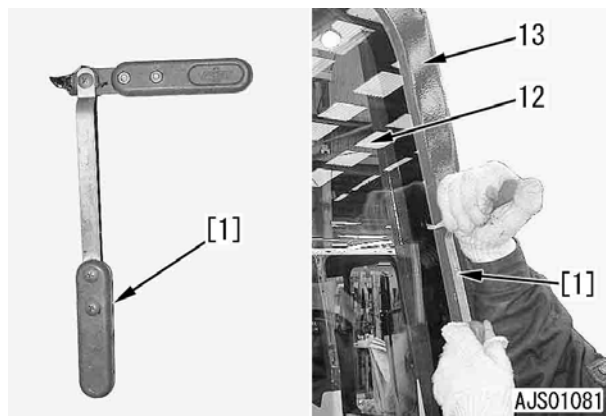
Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X 2	793-498-1210	Lifter (Suction cup)	■	2		

Removal

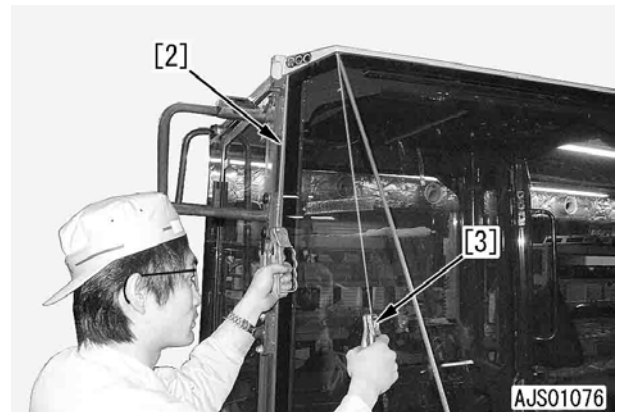
- ★ Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (12) and operator's cab (metal sheet) (13).



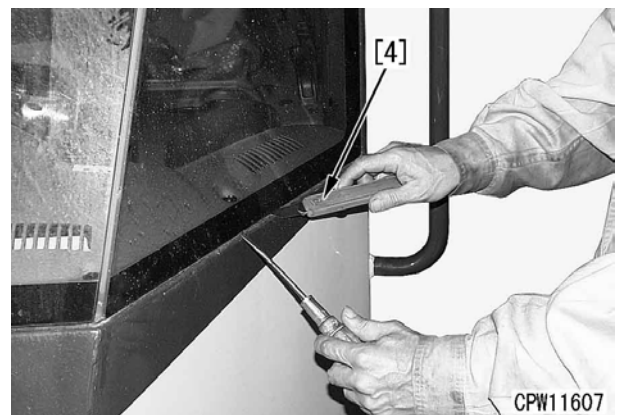
- ★ When seal cutter is not available
- 1) Make holes on the adhesive and double-sided adhesive tape with a drill and pass a fine wire (piano wire, etc.) [2] through the holes.
 - 2) Grip both ends of the wire with pliers [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and double-sided adhesive tape.
- ★ Since the wire may be broken by the frictional heat, apply lubricant to it.

(The figure shows the operator's cab of a wheel loader.)



- ★ If the window glass is broken finely, it may be removed with knife [4] and a screwdriver.
- ★ Widening the cut with a screwdriver, cut the adhesive and double-sided adhesive tape with knife [4].

(The figure shows the operator's cab of a wheel loader.)



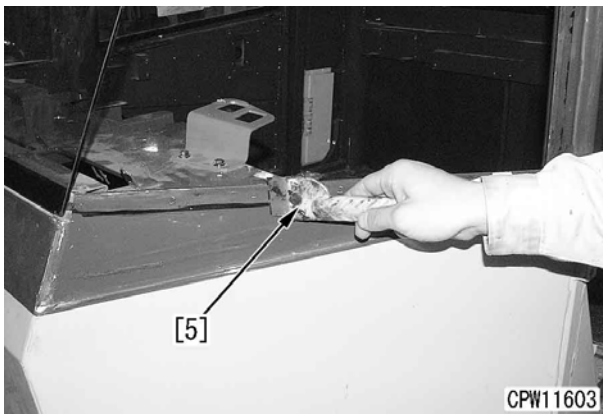
2. Remove the window glass.

Installation

1. Using a knife and scraper [5], remove the remaining adhesive and double-sided adhesive tape from the metal sheets (glass sticking surfaces) of the operator's cab.

- ★ Remove the adhesive and double-sided adhesive tape to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces. (If the painted surfaces are scratched, adhesion will be lowered.)

(The figure shows the operator's cab of a wheel loader.)



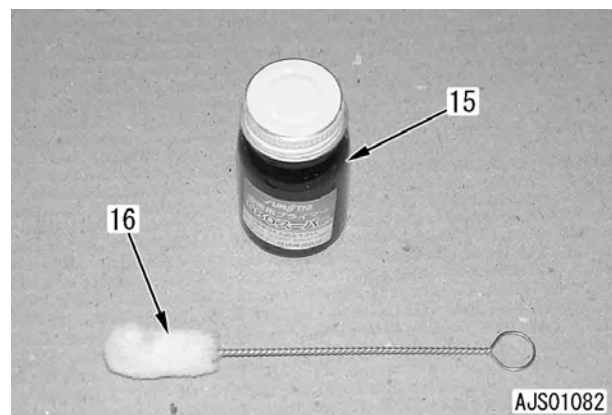
2. Remove oil, dust, dirt, etc. from the sticking surfaces of operator's cab (13) and window glass (14) with white gasoline.

- ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
- ★ Clean the all black part on the back side of the window glass.
- ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.



3. Apply primer (15).

- ★ Since the primer has a large effect on the adhesion of the glass, never apply a wrong primer. If you have applied a wrong primer by mistake, wipe it off with cleaning solvent.
 - ★ The using limit of primer is 4 months after the date of manufacture. Do not use primer after this limit.
 - ★ Use the primer within 2 hours after unpacking it.
 - ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is packed.)
- 1) Stir the primers for paint and glass sufficiently before using them.
 - ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
 - 2) When reusing primer brush (16), wash it in white gasoline.
 - ★ After washing the brush, check it again for dirt and foreign matter.
 - ★ Prepare respective brushes for the paint primer and glass primer.



- 3) Evenly apply paint primer to the surfaces to stick double-sided adhesive tapes (10) and the surfaces out of those surfaces on operator's cab (13) which will be coated with the adhesive.

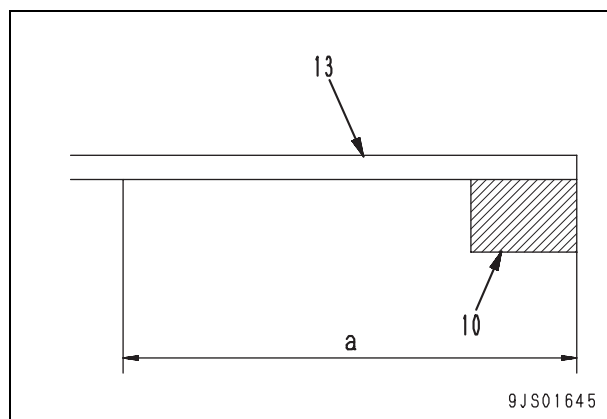
 Paint primer:

SUNSTAR PAINT PRIMER 435-95

- ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)



- ★ Parts to be coated with primer: Apply the primer all over dimension (a).
- Dimension to apply primer (a): **25 mm**



- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.

- 4) Evenly apply glass primer to the sticking surfaces of window glass (14).

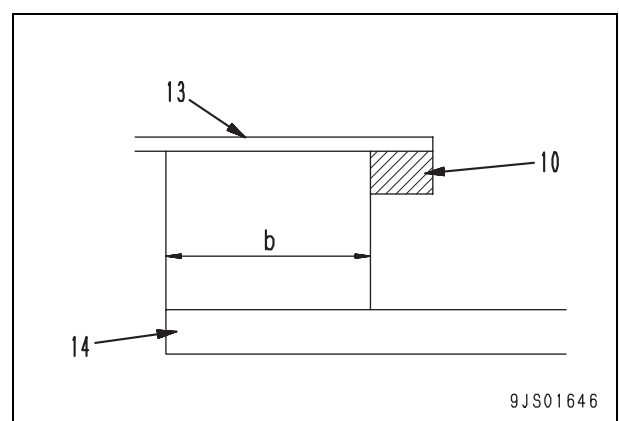
 Glass primer:

SUNSTAR GLASS PRIMER 435-41

- ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)



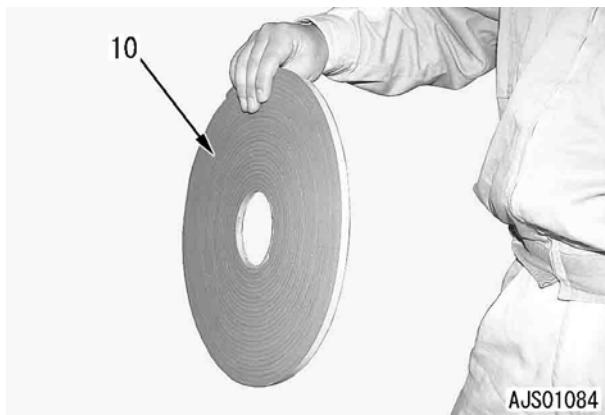
- ★ Parts to be coated with primer: Apply the primer to the sticking surfaces of window glass (14) and all over dimension (b) which will be on double-sided adhesive tape (10) and operator's cab (13).
- ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.



4. Stick double-sided adhesive tape (10) along the inside edge of the glass sticking section.
- ★ The double-sided adhesive tape is used to stop the adhesive from flowing out, finish the appearance neatly, apply the adhesive evenly and stabilize its strength, and protect the glass until the adhesive is set.
 - ★ The double-sided adhesive tape is classified into 2 types by the sectional dimensions. Use those types according to the following table.

Double-sided adhesive tape	Sectional size of double-sided adhesive tape
For general use	5 mm thick × 7 mm wide
For front sash	5 mm thick × 5 mm wide

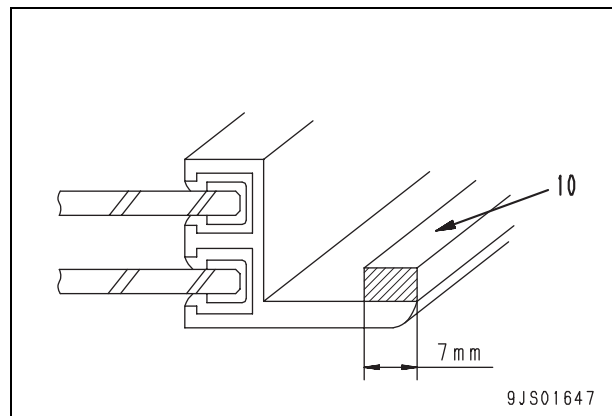
- ★ Do not remove the release tape of the double-sided adhesive tape on the glass sticking side before sticking the glass.
- ★ When sticking the double-sided adhesive tape, do not touch the cleaned surface as long as possible.
- ★ Take that the double-sided adhesive tape will not float at each corner of the window frame.



- ★ When sticking double-sided adhesive tape around a frame, do not lap its finishing end over the starting end, or you may make a clearance of about 5 mm between them.
- ★ Referring to the following, install the double-sided adhesive tape to each glass sticking part.

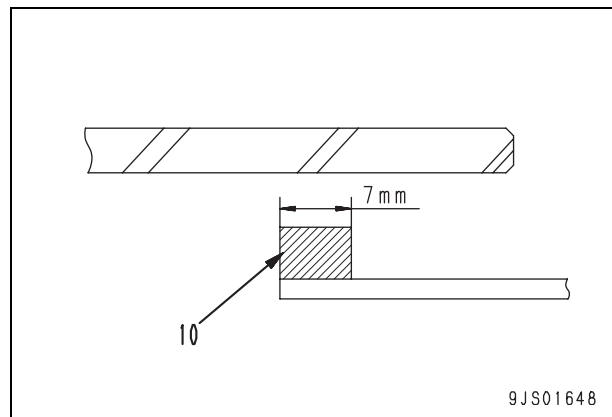
Sliding sash

- ★ Install the double-sided adhesive tape along the periphery of the sticking face of the sash.



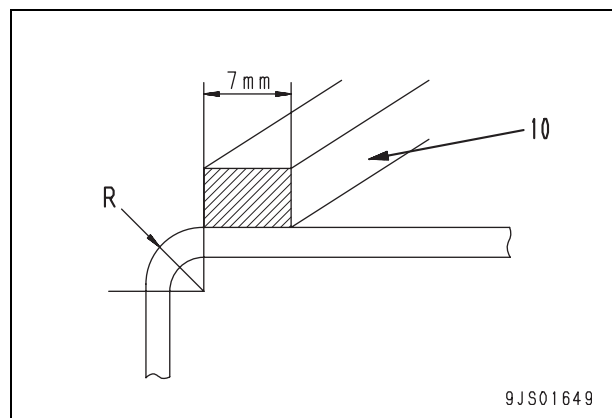
Sheet metal part

- ★ Install the double-sided adhesive tape along the edge of the sheet metal part.



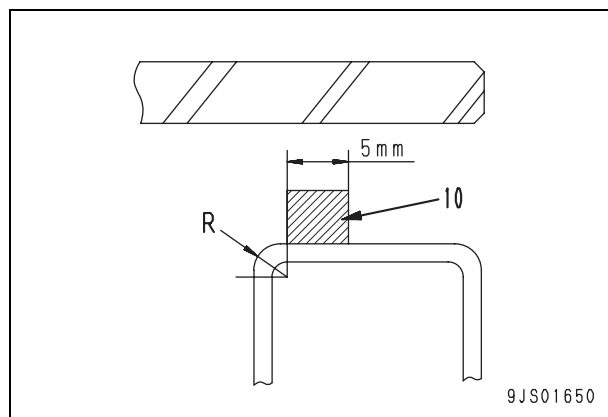
Pipe

- ★ Install the double-sided adhesive tape from the end of the round part of each corner of the pipe.

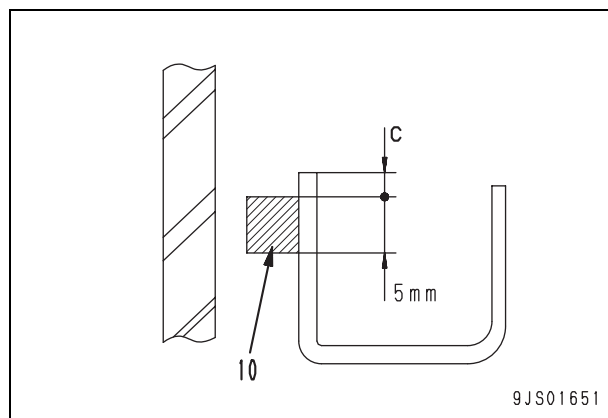


Front sash (Glass sticking side)

- Right and left frames

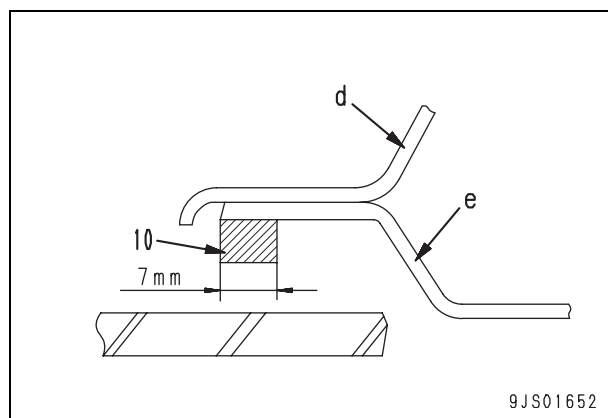


- Bottom frame
- Dimension (c): 2.4 mm



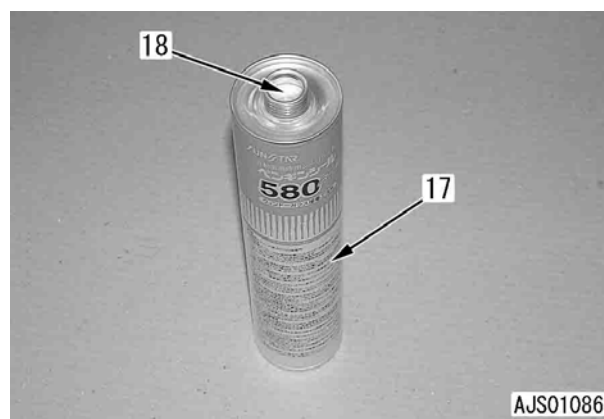
Door (Glass sticking side)

- ★ Install the double-sided adhesive tape along the outer end of the door.
- (d): Inner, (e): Outer

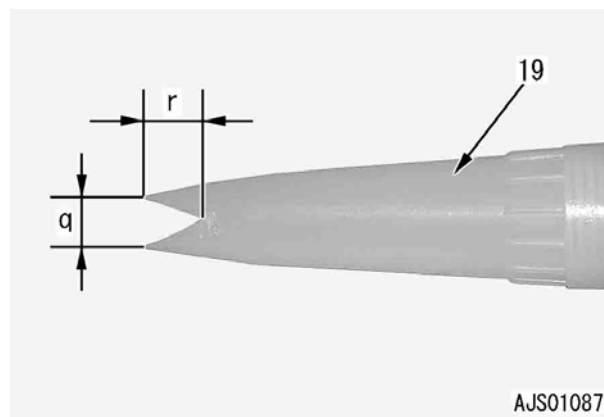


5. Apply adhesive.

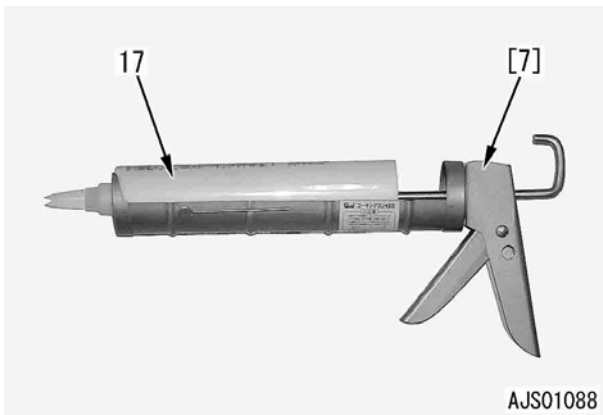
- ★ The using limit of the adhesive is 6 months after the date of manufacture. Do not use the adhesive after this limit.
 - ★ Keep the adhesive in a dark place where the temperature is below 25°C.
 - ★ Never heat the adhesive higher than 30°C.
 - ★ When reusing the adhesive, remove the all hardened part from the nozzle tip.
- 1) Break aluminum seal (18) of the outlet of adhesive cartridge (17) and install the nozzle.



- 2) Cut the tip of the adhesive nozzle (19) so that dimensions (q) and (r) will be as follows.
 - Dimension (q): 10 mm
 - Dimension (r): 15 mm



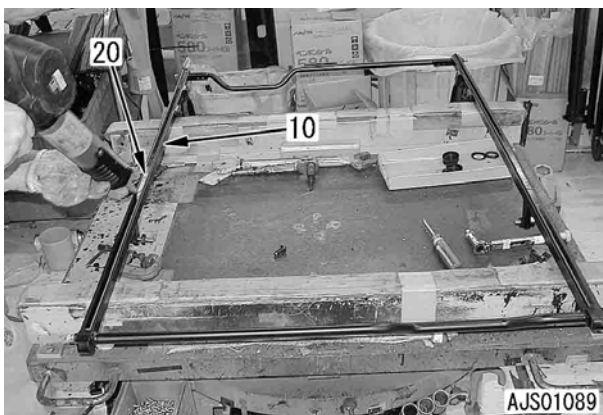
- 3) Set adhesive cartridge (17) to caulking gun [7].
★ An electric caulking gun is more efficient.



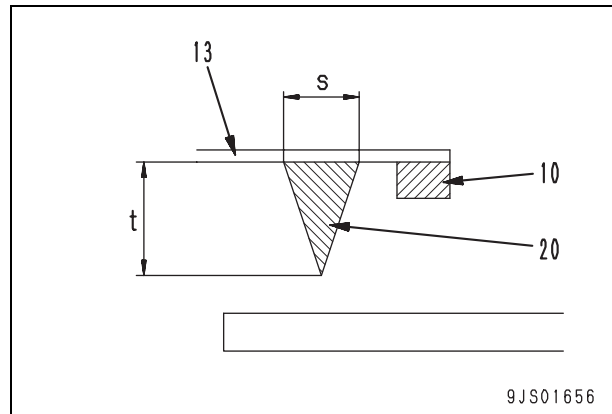
- 4) Remove the release tape of the double-sided adhesive tape on the glass side.
5) Apply adhesive (20) to the outside of double-sided adhesive tape (10) of the operator's cab.

🔧 Adhesive:

SUNSTAR PENGUINE SUPER 560

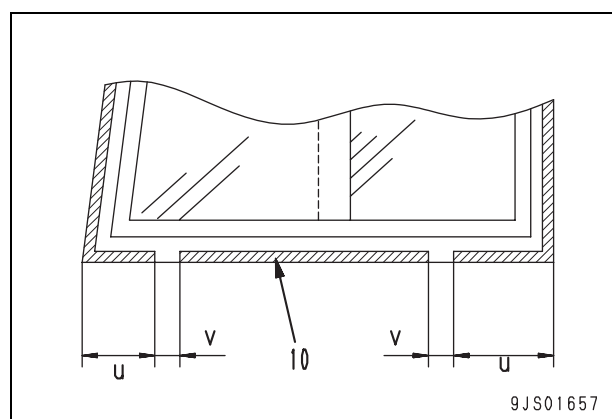


- ★ Apply adhesive (20) to dimensions (s) and (t) of double-sided adhesive tape (10) of operator's cab (13).
 - Dimension (s): **10 mm**
 - Dimension (t): **15 mm**
- ★ Apply adhesive (20) higher than double-sided adhesive tape (10).
- ★ Apply the adhesive evenly.

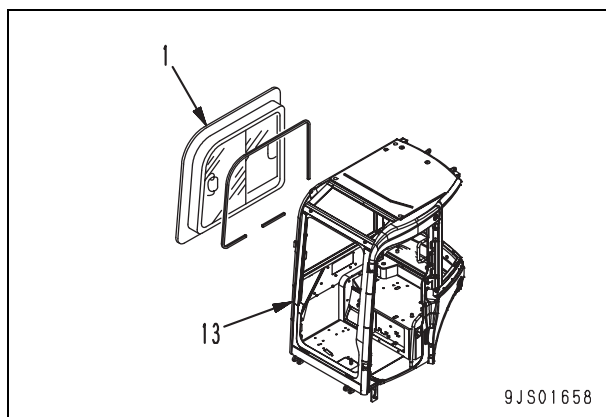


6. Install the sliding sash assembly.

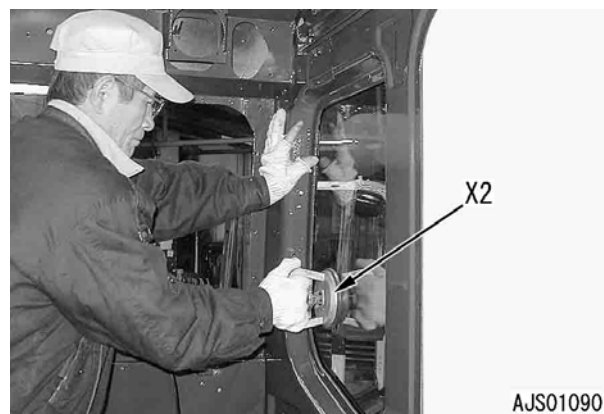
- 1) Clean the sash sticking face on the cab side and the sash flange sticking face with cleaning solvent according to steps 1 and 2 above.
- 2) Apply the primer according to step 3 above.
 - ★ Use the right primer for the right sash.
 - ★ When sash has metallic shine:
Primer: SUNSTAR PRIMER GP-402 for sash
 - ★ When sash is painted black and does not have metallic shine:
Primer: SUNSTAR PRIMER 435-95 for painted surface
 - ★ Do not apply the primer to the following water draining area.
- 3) Install the double-sided adhesive tape according to step 4 above.
 - ★ To drain water from around the sash, avoid installing double-sided adhesive tape (10) of the bottom side to the area of dimension (v).
 - Dimension (u): **150 mm**, (v): **50 mm**



- 4) Apply the adhesive according to step 5 above.
 - ★ Do not apply the adhesive to the above water draining area.
- 5) Install sliding sash assembly (1) to operator's cab (13).
 - ★ Press the sash assembly firmly to eliminate clearance from its periphery.
 - ★ If the adhesive is projected, wipe it off immediately before it is set.

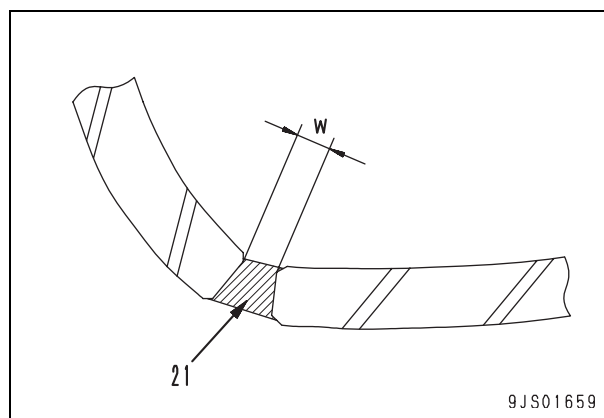


(The figure shows the operator's cab of PC200-7.)




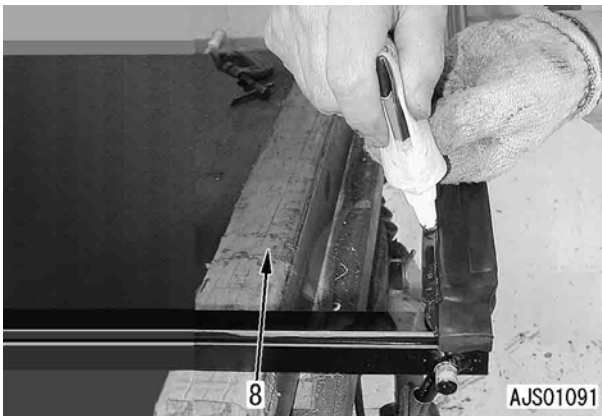
- ★ Make a clearance of the following dimension in each corner joint of the rear glass and fix the joint with caulking material (21).
- Dimension (w): **3 mm**
- Caulking material:
GE TOSHIBA SILICONE TOSSEAL 381

- 6) After installing the sliding sash assembly, fix it with bands, etc. for about 10 hours.
7. Install the window glass and clear plate.
 - 1) Clean the glass sticking face on the cab side and the sticking face of the glass with cleaning solvent according to steps 1 and 2 above.
 - 2) Apply the primer according to step 3 above.
 - 3) Install the double-sided adhesive tape according to step 4 above.
 - 4) Apply the adhesive according to step 5 above.
 - 5) Stick the glass to the cab.
 - ★ Since the window glass cannot be removed and stuck again, stick it very carefully.
 - ★ Stick the glass within 5 minutes after applying the adhesive.
 - 6) After sticking the window glass, press all around it until it is stuck to the double-sided adhesive tape.
 - ★ Press the corners of the window glass firmly, in particular.
 - ★ You can perform this work efficiently by pulling the window glass from inside of the operator's cab with lifter X2.

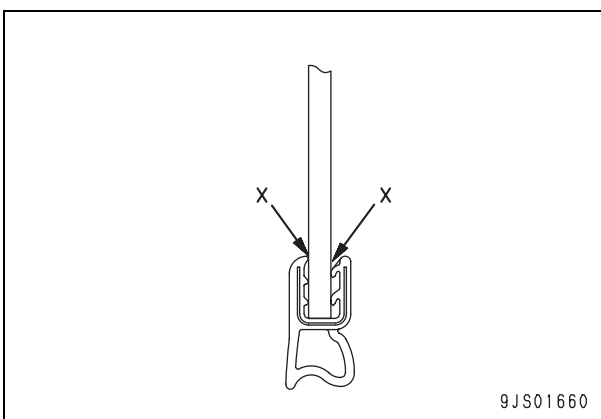


- 7) After sticking the glass, fix it with bands, etc. for about 10 hours.

8. Protect the stuck window glass.
- 1) Keep the stopper rubbers, styrene foam blocks, and rubber bands installed for 10 hours (at temperature of 20°C and humidity of 60%).
 - 2) After removing the stopper rubbers, styrene foam blocks, and rubber bands, wait at least 14 hours, at least 24 hours in total, before operating the machine actually.
 - ★ After installing front window glass (8), install the center trim seal to its bottom.
 - ★ When caulking, neatly arrange the form of the adhesive at the right and left ends with a rubber spatula.
-  Adhesive:
Sikaflex 256HV manufactured by Sika Japan



- ★ Apply caulking material all around the glass to fill part (x) between the glass and center trim seal.



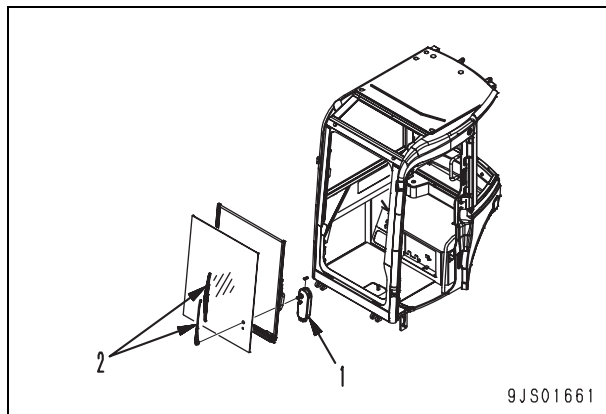
Removal and installation of front window assembly

⚠ Lower the work equipment to the ground and stop the engine.

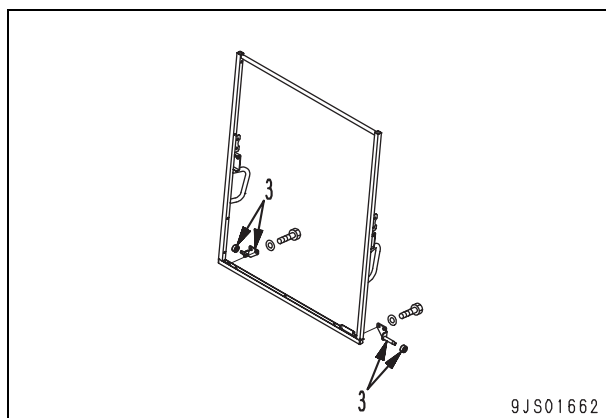
- ★ To replace the front window glass, the front window assembly must be removed from the operator's cab. The procedure for removing and installing the front window assembly (front frame and front window glass) is explained below.

Removal

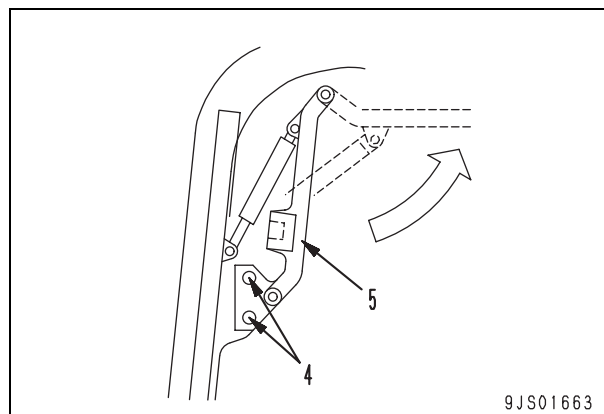
1. Lower the front window assembly.
2. Remove wiper motor (1) and wiper blade (2).
 - ★ Remove the coiled cable for the wiper from the sash and secure it in the operator's cab.



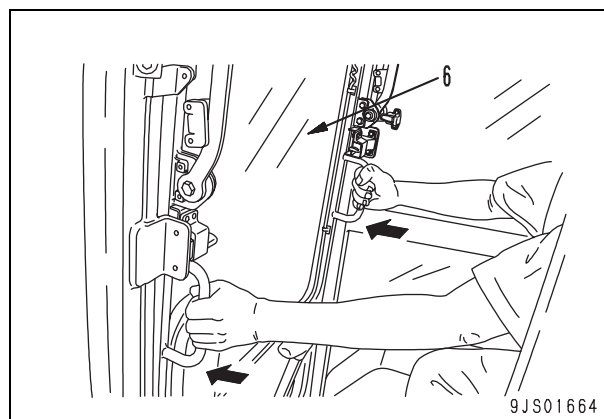
3. Remove rollers (3) (right and left) from the bottom of the sash.



4. Remove bolt (4) and separate pull-up link (5) from the sash and set it up toward the ceiling.



5. Holding the handle, release the latch and remove the front window assembly (6).



Installation

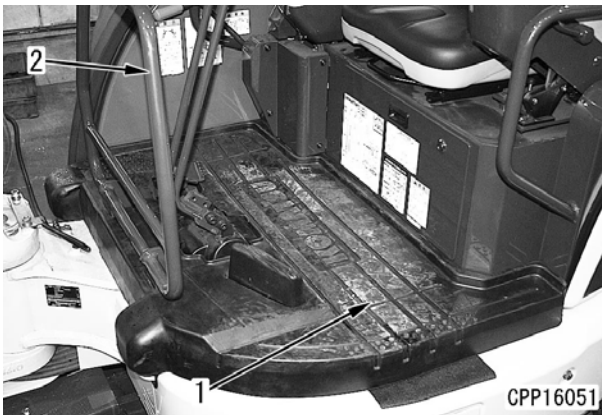
- Carry out installation in the reverse order to removal.

Removal and installation of floor frame assembly

Removal

⚠ **Disconnect the cable from the negative (-) terminal of the battery.**

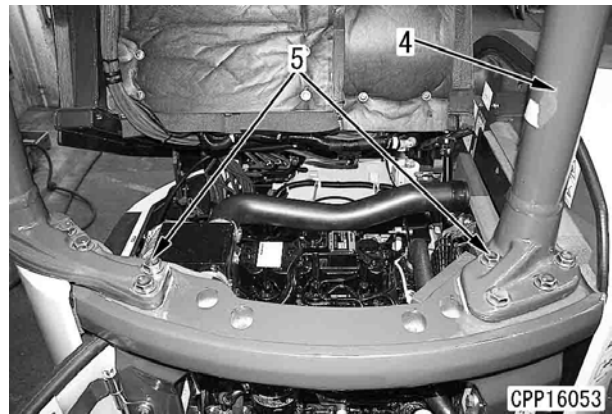
1. Release the air pressure in the hydraulic tank. For details, see Testing and adjusting, "Releasing air in hydraulic tank".
2. Remove floor mat (1) and bar (2).
 - ★ Perform this step for only the model with the canopy specification.




3. Remove canopy according to the following procedure.
 - ★ Canopy specification only.
 - 1) Remove roof (3).
 - 2) Tilt up the floor frame. For details, see Testing and adjusting, How to open and close (tilt) floor.



- 3) Sling canopy (4) temporarily, remove 8 mounting bolts (5).



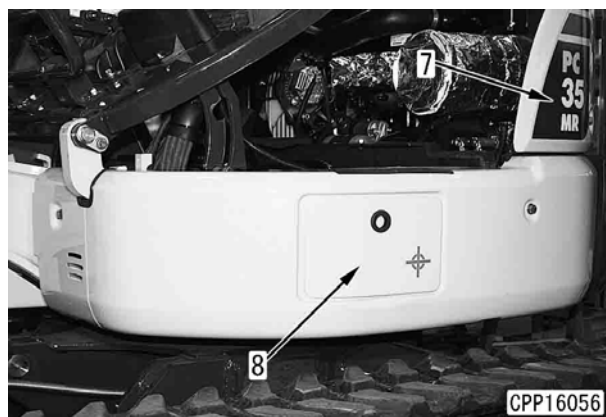
- 4) Lift off canopy (4).
 Canopy: 77 kg



4. Remove all the mounting bolts of plate (6) on the right side of the engine.
 - ★ For details, refer to "Removal and installation of radiator and hydraulic oil cooler, step 5".



5. Remove covers (7), (8).



6. Disconnect work equipment PPC hoses (9) and (10), 8 pieces in total. [*1]

★ Hose band colors

Hoses (9) on this side from above:

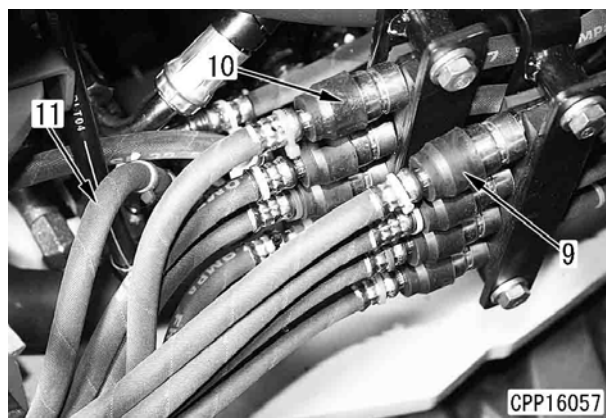
White, green, brown, and orange

Hoses (10) on the deeper side from above:

Blue, yellow, red, and black

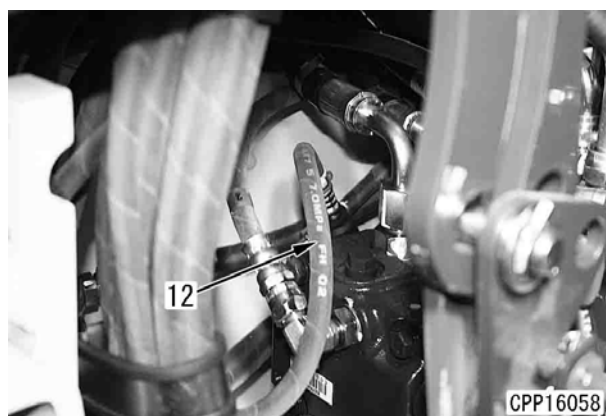
7. Disconnect hose (11).

★ Identification tape colors of hoses:
"Yellow, blue"



8. Disconnect hose (12).

★ Identification tape colors of hoses:
"Yellow, red"



9. Disconnect 4 travel PPC hoses (13). [*3]

★ Identification tape colors of hoses

Right front: "Black, yellow"

Right rear: "Yellow, green"

Left front: "Yellow, brown"

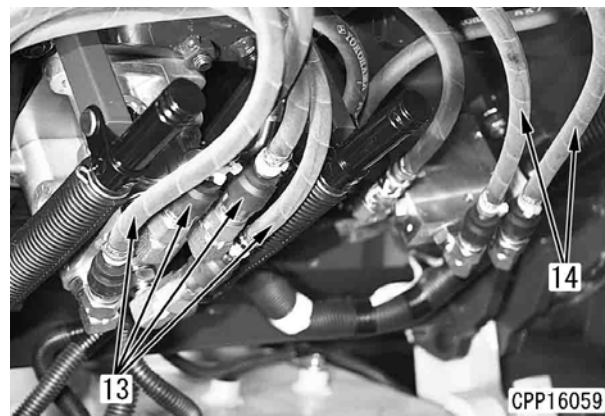
Left rear: "Yellow, orange"

10. Disconnect 2 swing PPC hoses (14). [*4]

★ Identification tape colors of hoses

Right side: "Blue, white"

Left side: "Red, white"

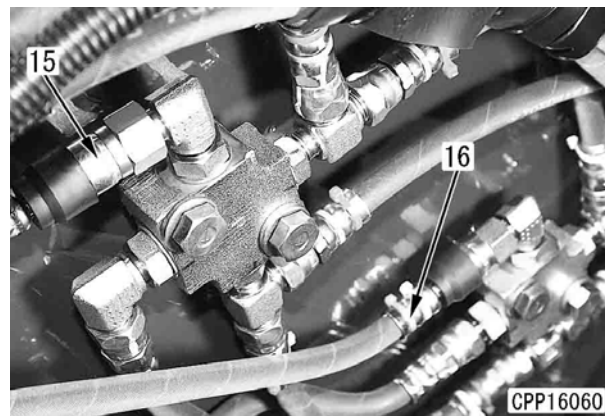


11. Disconnect hoses (15), (16).

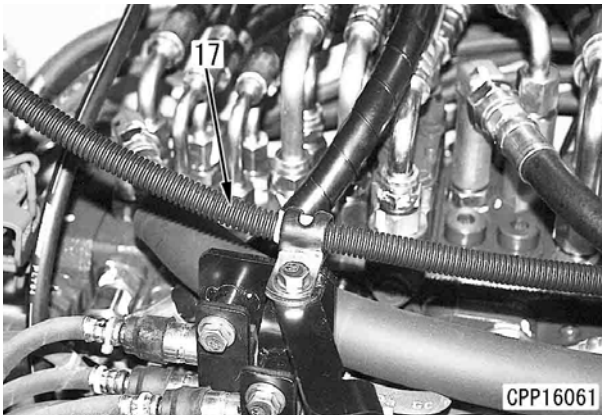
★ Identification tape colors of hoses:

15: —

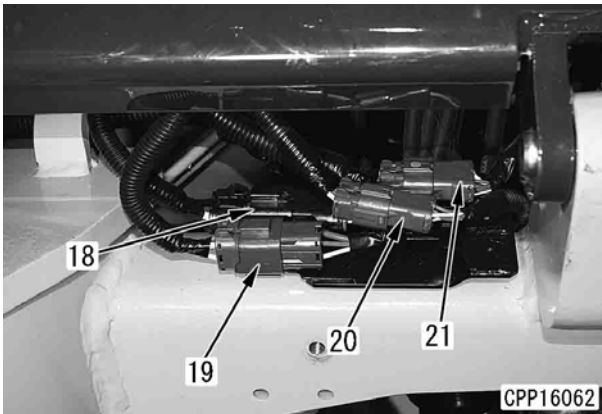
16: "Blue, white"



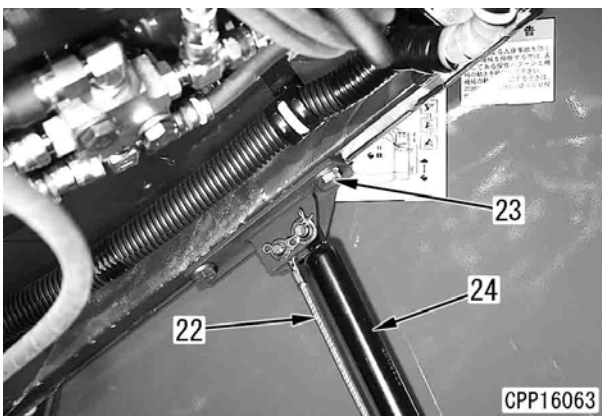
12. Disconnect fuel control cable (17) from the engine and pull it out toward the front of the engine. [*2]
★ Check the route of the cable.



13. Disconnect connectors (18) – (21) in front of the revolving frame.

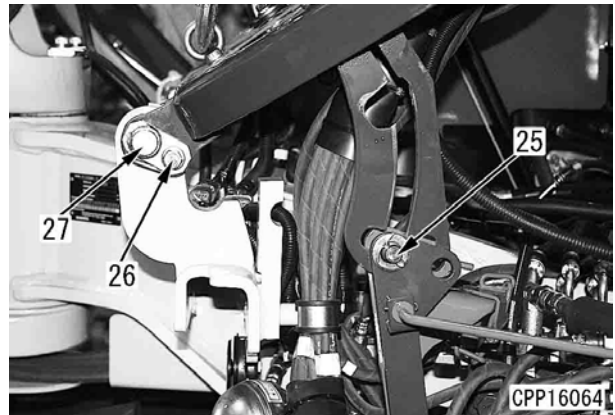


14. Sling the canopy and floor frame (operator's cab and floor frame) assembly temporarily.
15. Disconnect wire (22) from the floor frame.
16. Loosen 2 bolts (23) gradually and alternately to disconnect damper (24).



17. Pull out pin (25).

18. Remove right and left bolts (26) and pull out pin (27). [*5]



19. Lift off canopy and floor frame (operator's cab and floor frame) assembly (28).
★ Check that all the wires and pipes have been disconnected.
★ When removing the assembly, take care of its balance.
★ Do not remove the canopy singly.
★ The operator's cab and the floor frame are made in 1 unit.

Canopy and floor frame assembly: **290 kg**
Cab and floor frame assembly: **400 kg**

Canopy specification



Cab specification



AJF01436

Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ When connecting, check the identification colors.

[*2]

- ★ Adjust the cable tension. For details, see Testing and adjusting, "Testing and adjusting fuel control lever".

[*3], [*4]

- ★ When connecting, check the identification marks and colors.

[*5]

- ⚠ When positioning, do not insert your finger.

- **Refilling with oil (Hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

PC27MR, PC30MR, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

50 Disassembly and assembly

800 Electrical system

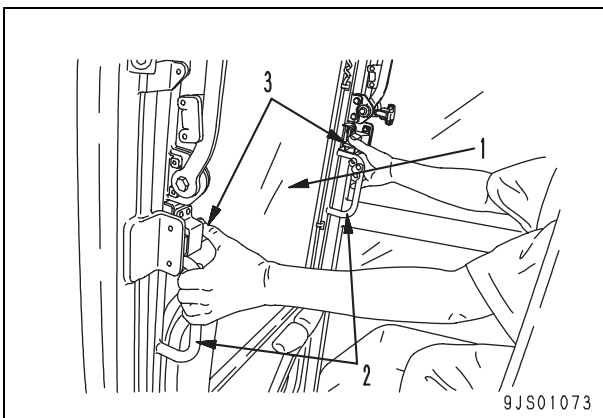
Removal and installation of air conditioner unit assembly (If equipped) 2

Removal and installation of air conditioner unit assembly (If equipped)

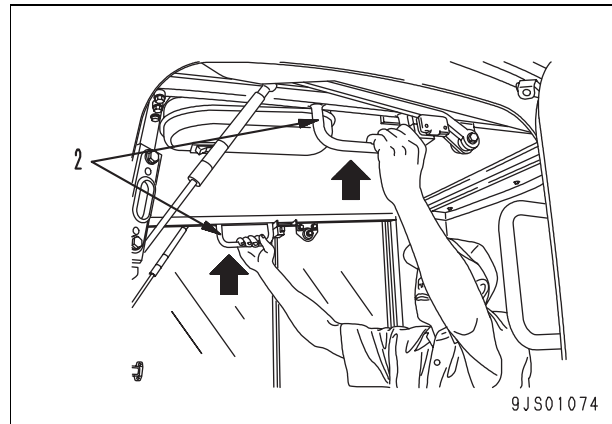
Removal

- ⚠ Stop the machine on a level place, lower the work equipment to the ground, and set the work equipment lock lever in the LOCK position.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- ⚠ In the case that you do not drain the coolant, if you disconnect the heater hose when the coolant temperature in the radiator is high, you may be scalded. In this case, wait until the coolant temperature lowers and then disconnect the heater hose.
- ⚠ Collect the air conditioner refrigerant (R134a) from air conditioner circuit in advance.
- ★ Ask professional traders for collecting and filling operation of refrigerant (R134a).
- ★ Never release the refrigerant (R134a) to the atmosphere.
- ⚠ If refrigerant gas (R134a) gets in your eyes, you may lose your sight. Accordingly, put on protective goggles while you are collecting the refrigerant (R134a) or filling the air conditioner circuit with the refrigerant (R134a). Collecting and filling work must be conducted by a qualified person.

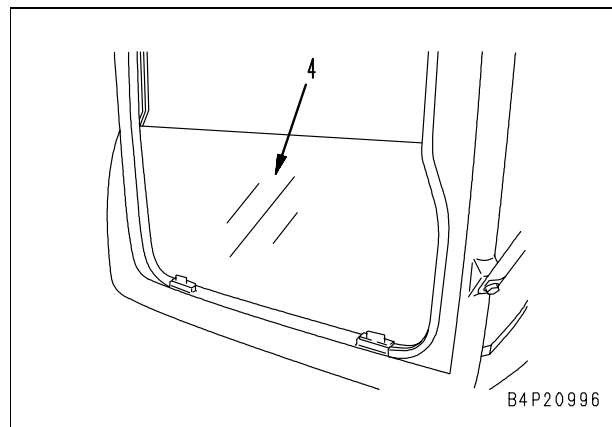
1. Collect the refrigerant (gas) from the air conditioner circuit. [*1]
2. Retract front window (upper side) (1) in the ceiling.
 - 1) Hold right and left grips (2) in the operator's cab and pull them toward you, keeping lock levers (3) down.



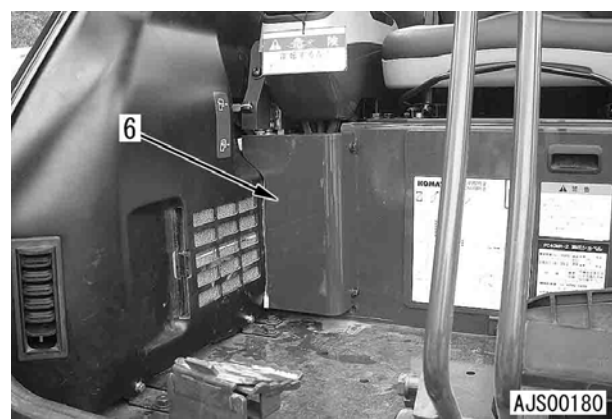
- 2) Pull up the front window. When it stops moving backward, push up grips (2) until they are locked securely.



3. Remove front window (lower side) (4).



4. Remove the floor mat and right PPC hose cover (6).

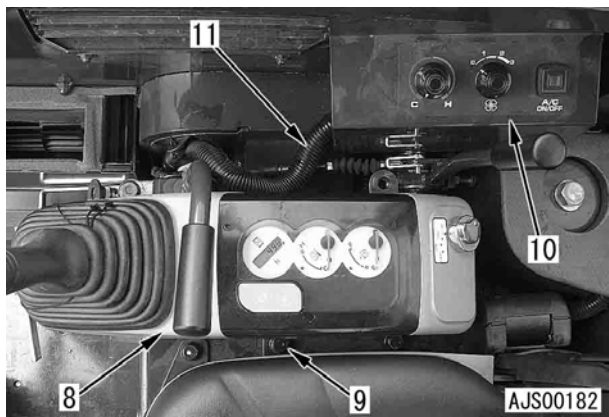


5. Remove cover (7).



6. Remove 3 mounting bolts (9) of right lever stand (8) so that the stand will move.

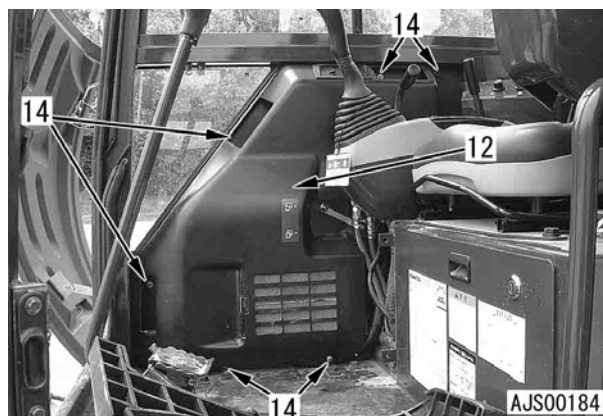
7. Remove air conditioner control panel (10) and clamp of wiring harness (11).



8. Remove cover (12).
1) Move the right lever stand backward.
2) Remove 3 air outlets (13).



- 3) Remove 6 mounting bolts (14) and cover (12).

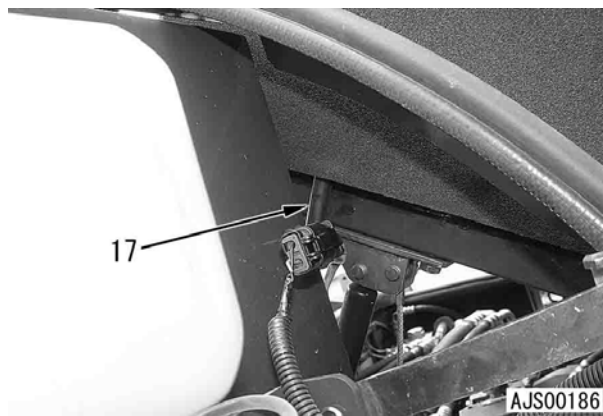


9. Remove cover (16).



10. Tilt up the floor frame.
For details, see Testing and adjusting, "How to open and close (tilt) floor".

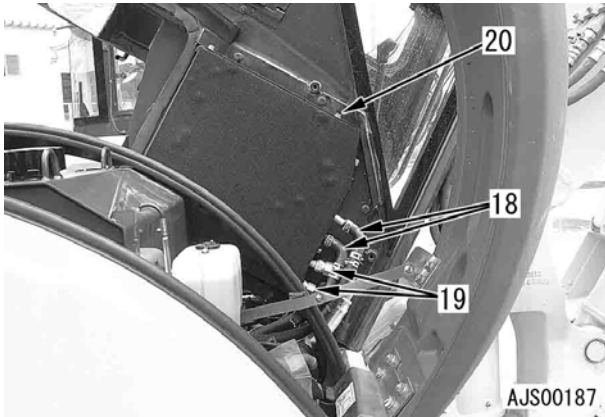
11. Disconnect drain hose (17).



12. Disconnect 2 heater hoses (18) and 2 air conditioner tubes (19). [^{*2}]

★ Plug the hoses to prevent dirt from entering them.

13. Remove 4 air conditioner unit assembly mounting bolts (20).



14. Tilt down the floor frame.

15. Pull air conditioner unit assembly (21) toward you and remove it and control panel together.

★ After pulling out the air conditioner unit assembly halfway, disconnect connector F11.



Installation

- Carry out installation in the reverse order to removal.

★ When installing, check that the O-ring is fitted to each joint of the air conditioner hoses.
★ Check that each O-ring is free from damage and deterioration.

[^{*1}]

★ Charge the air conditioner circuit with refrigerant (R134a).

[^{*2}]

★ Apply compressor oil (ND-OIL8) to the threaded part of each refrigerant pipe and tighten the pipe with double spanner.

⌘ M16 x 1.5 thread of tube:

11.8 – 14.7 Nm {1.2 – 1.5 kgm}

M24 x 1.5 thread of tube:

29.4 – 34.3 Nm {3.0 – 3.5 kgm}

PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

90 Diagrams and drawings

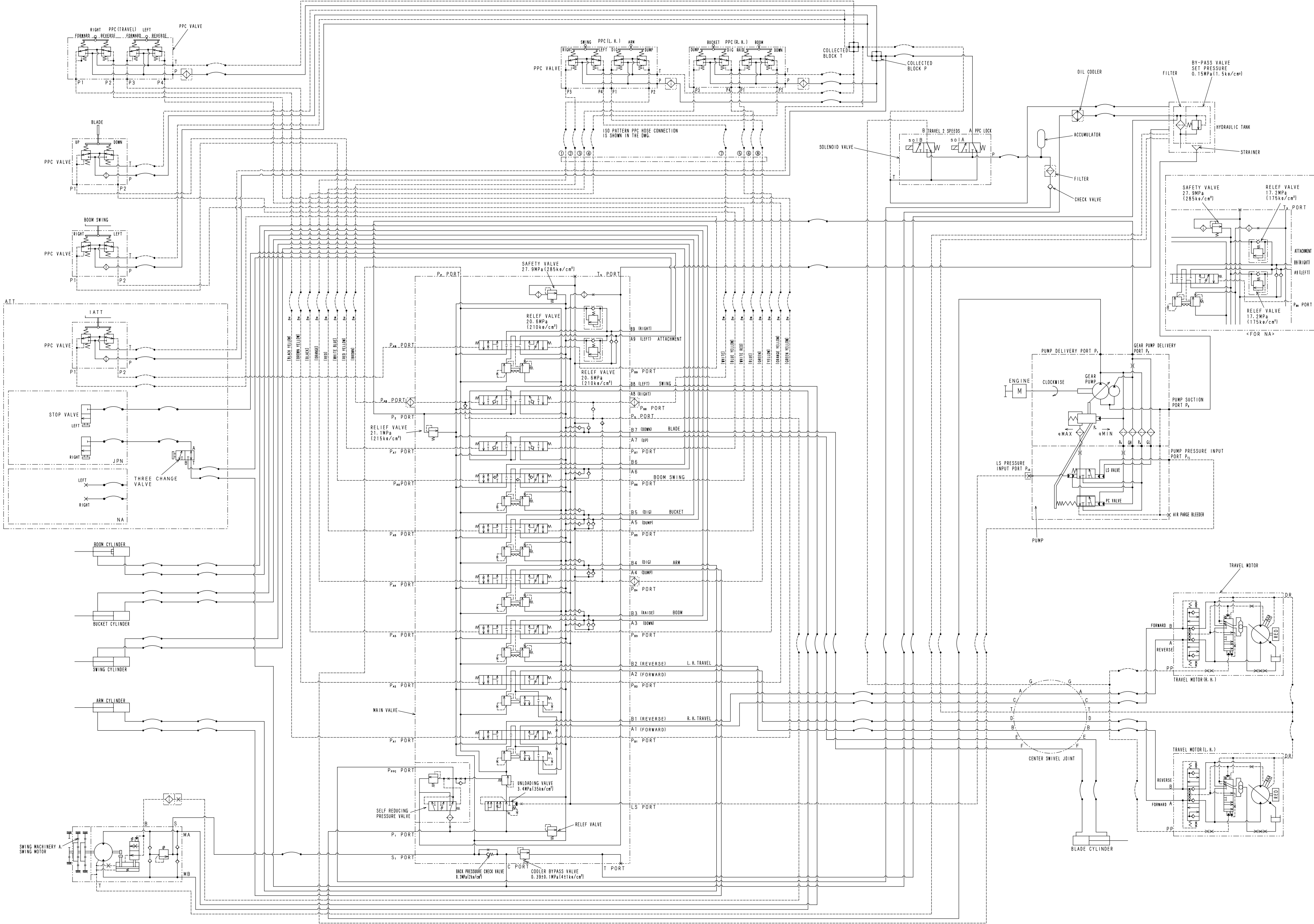
100 Hydraulic diagrams and drawings

Hydraulic circuit diagram.....	3
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Hydraulic circuit diagram
PC27MR-3

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

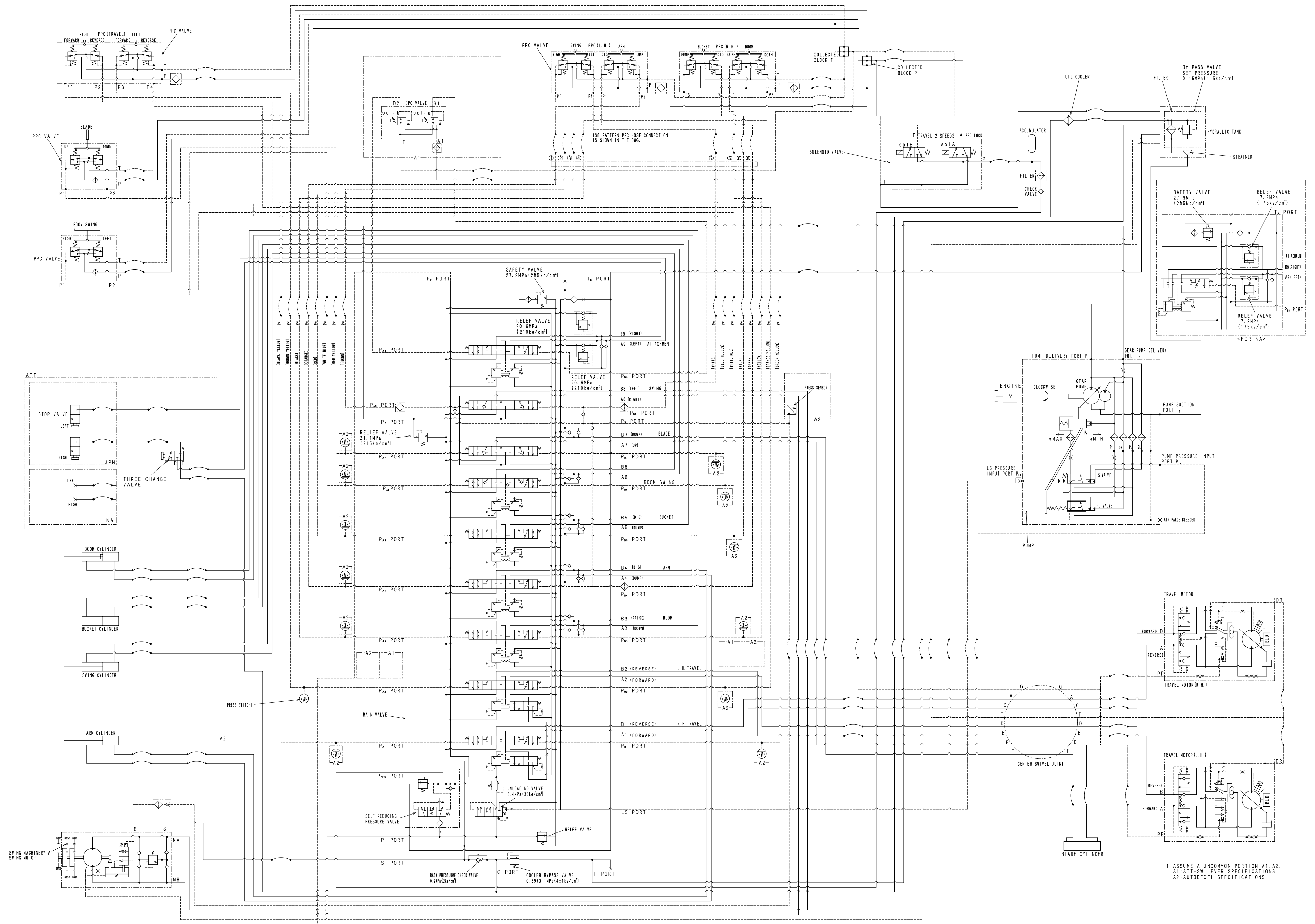
Hydraulic circuit diagram
PC27MR-3



PC27MR-3
(Auto-deceleration specification)

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

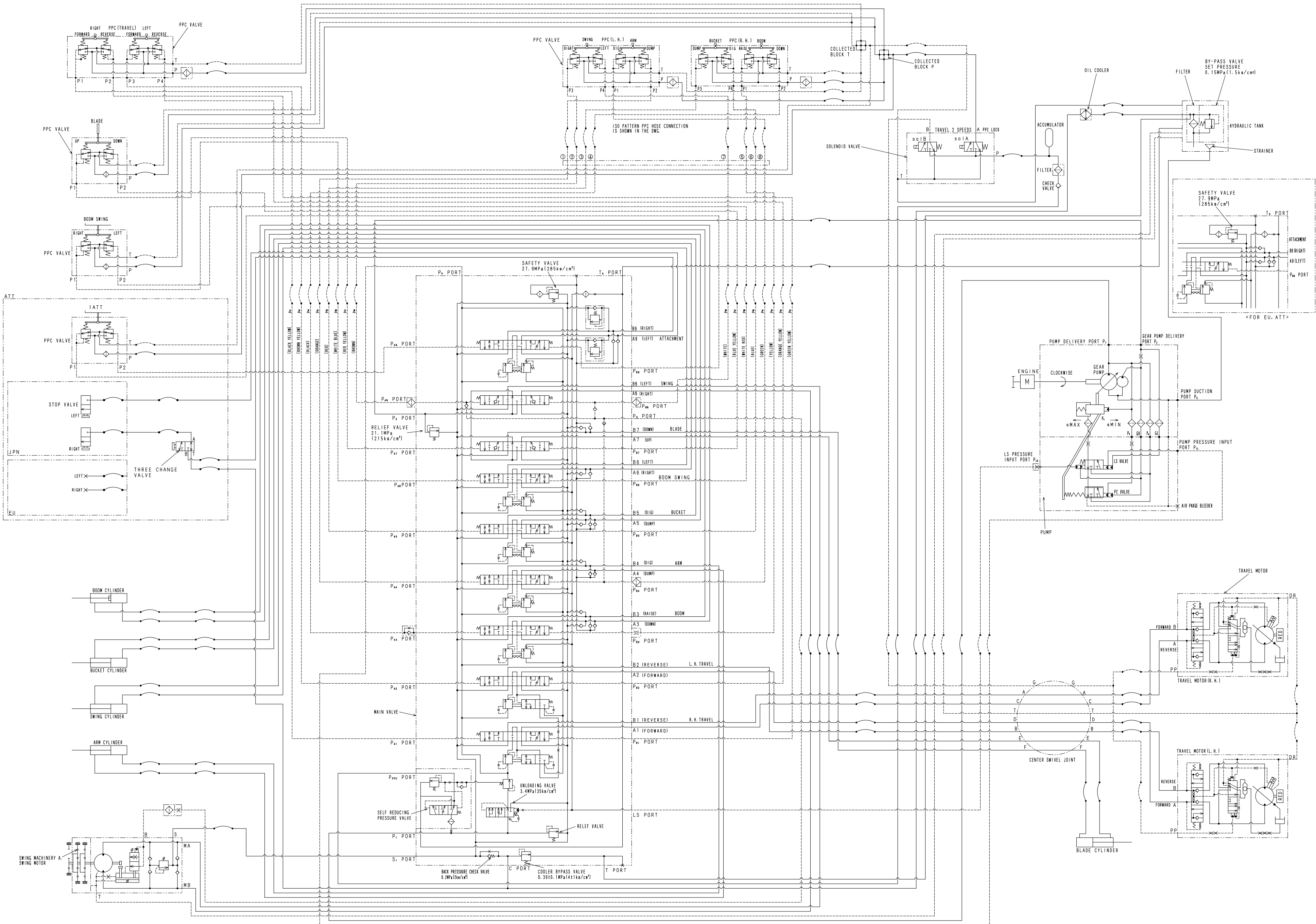
Hydraulic circuit diagram
PC27MR-3
(Auto-deceleration specification)



Hydraulic circuit diagram
PC30MR-3

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

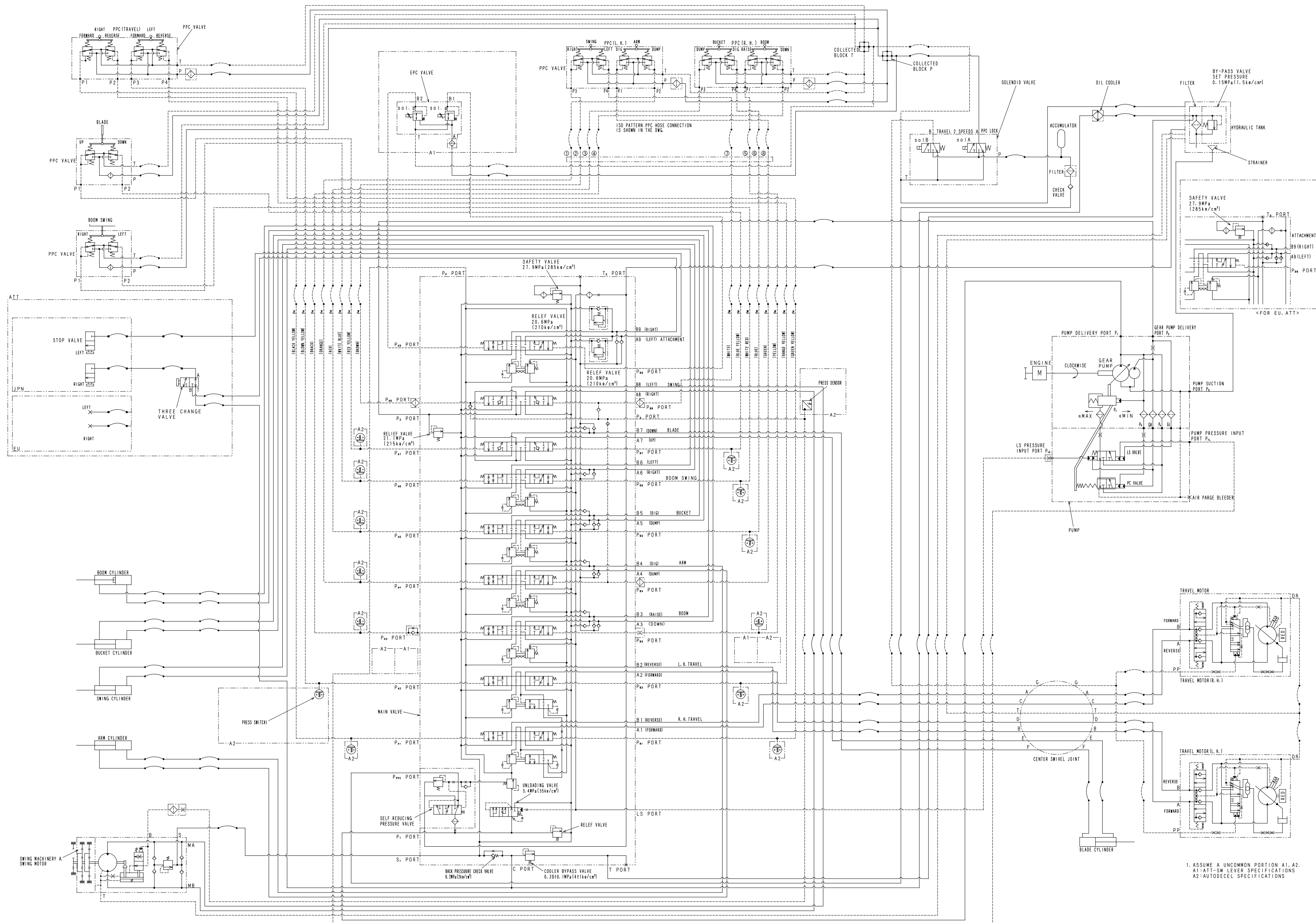
Hydraulic circuit diagram
PC30MR-3



PC30MR-3

(Auto-deceleration specification)

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

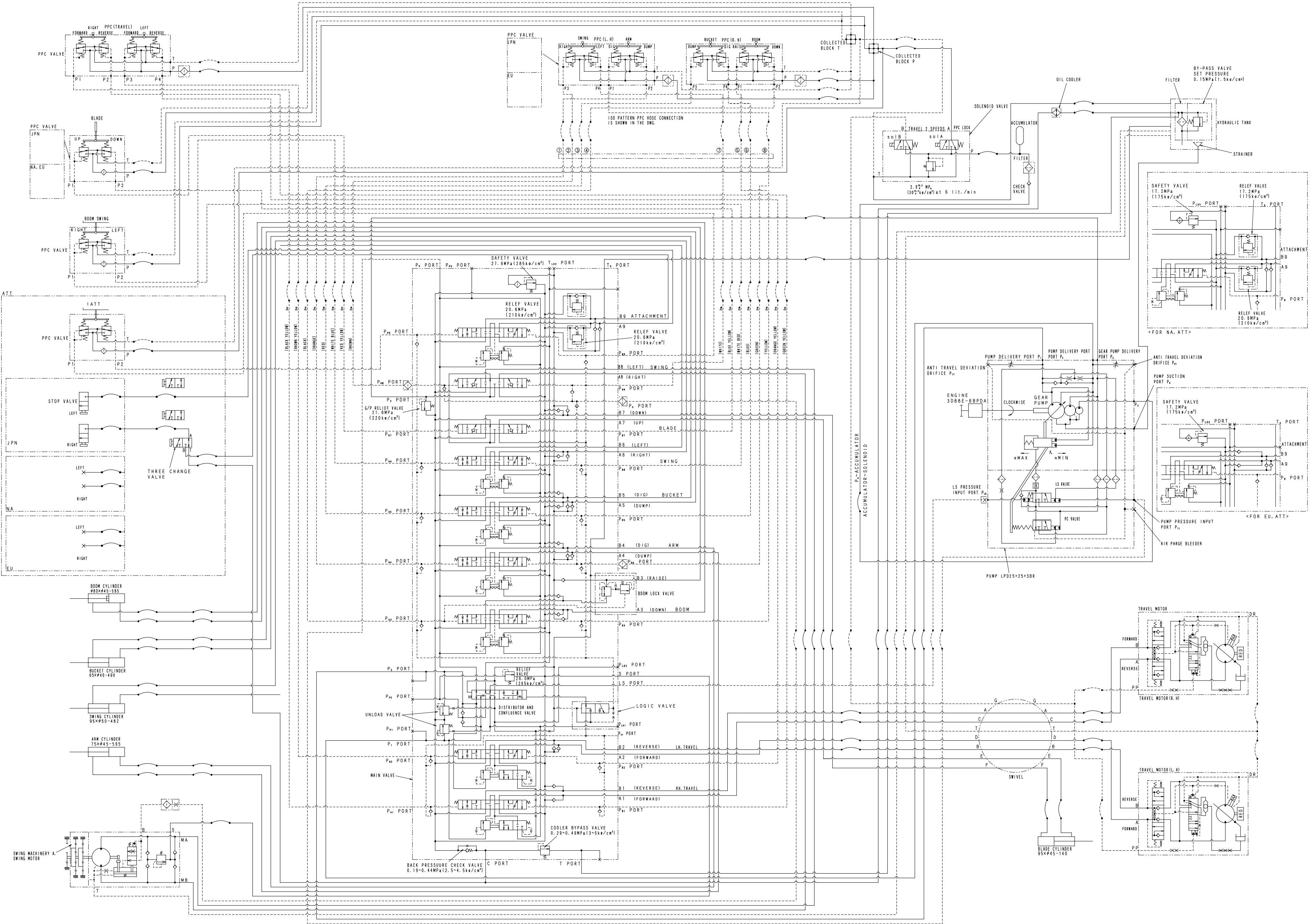


1. ASSUME A UNCOMMON PORTION A1, A2.
A1: ATT-SW LEVER SPECIFICATIONS
A2: AUTODECEL SPECIFICATIONS

Hydraulic circuit diagram
PC35MR-3

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

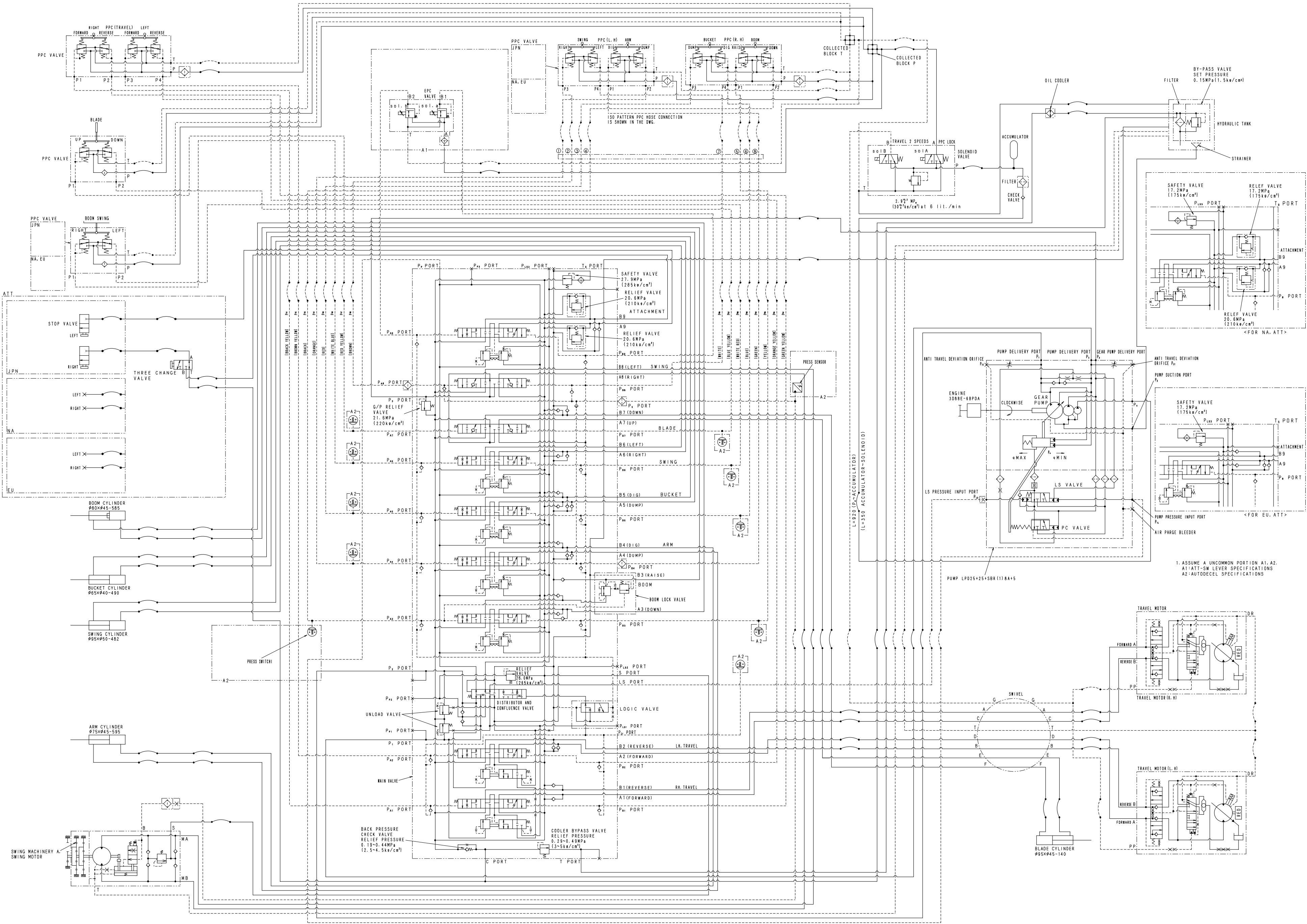
Hydraulic circuit diagram
PC35MR-3



Hydraulic circuit diagram
PC35MR-3
(Auto-deceleration specification)

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

Hydraulic circuit diagram
PC35MR-3
(Auto-deceleration specification)



PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC27MR-3

PC30MR-3

PC35MR-3

Machine model	Serial number
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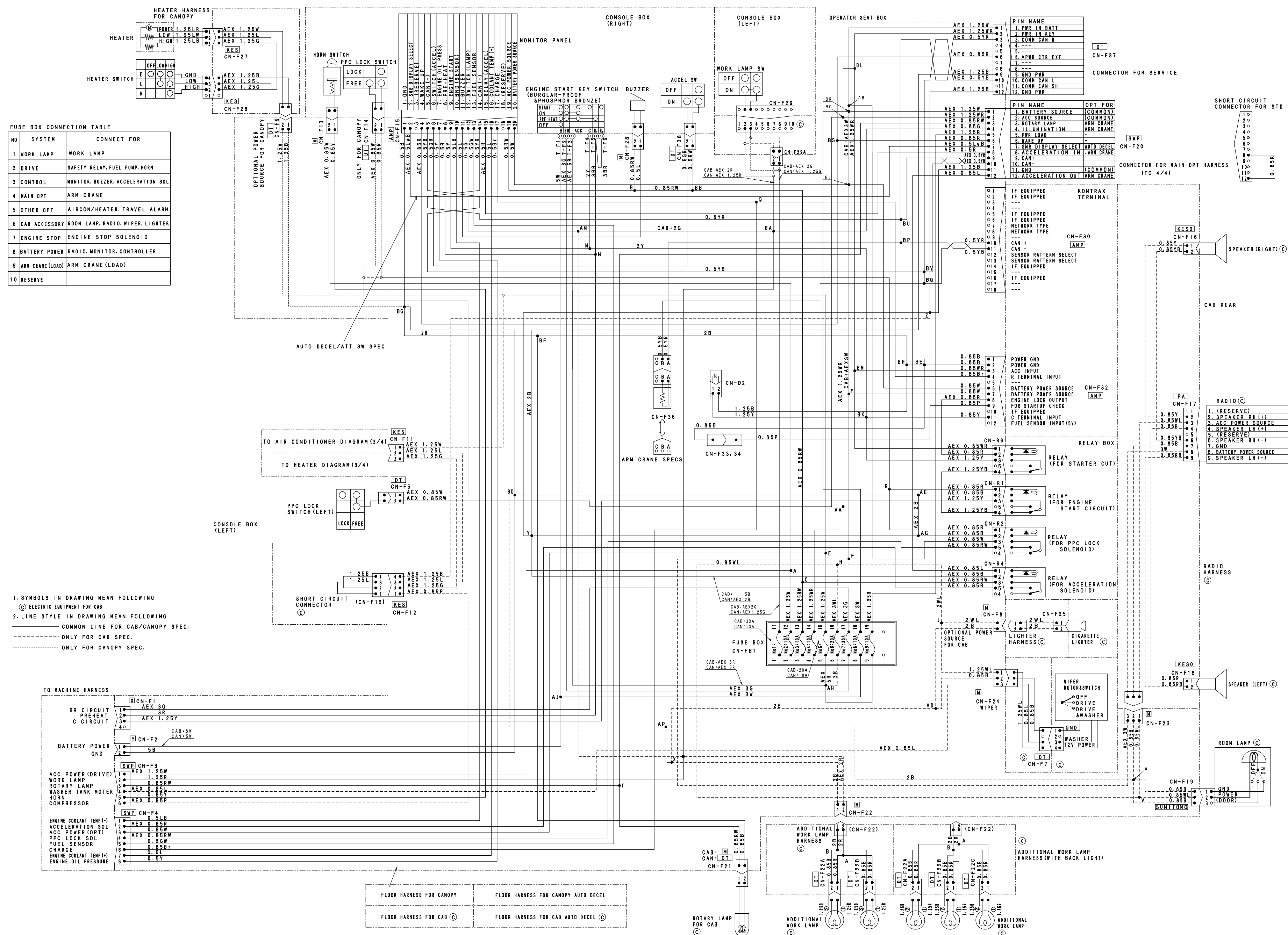
PC27MR-3	20002 and up
PC30MR-3	30001 and up
PC35MR-3	15001 and up

90 Diagrams and drawings

200 Electrical diagrams and drawings

Electrical circuit diagram	3
Connector list and stereogram.....	11

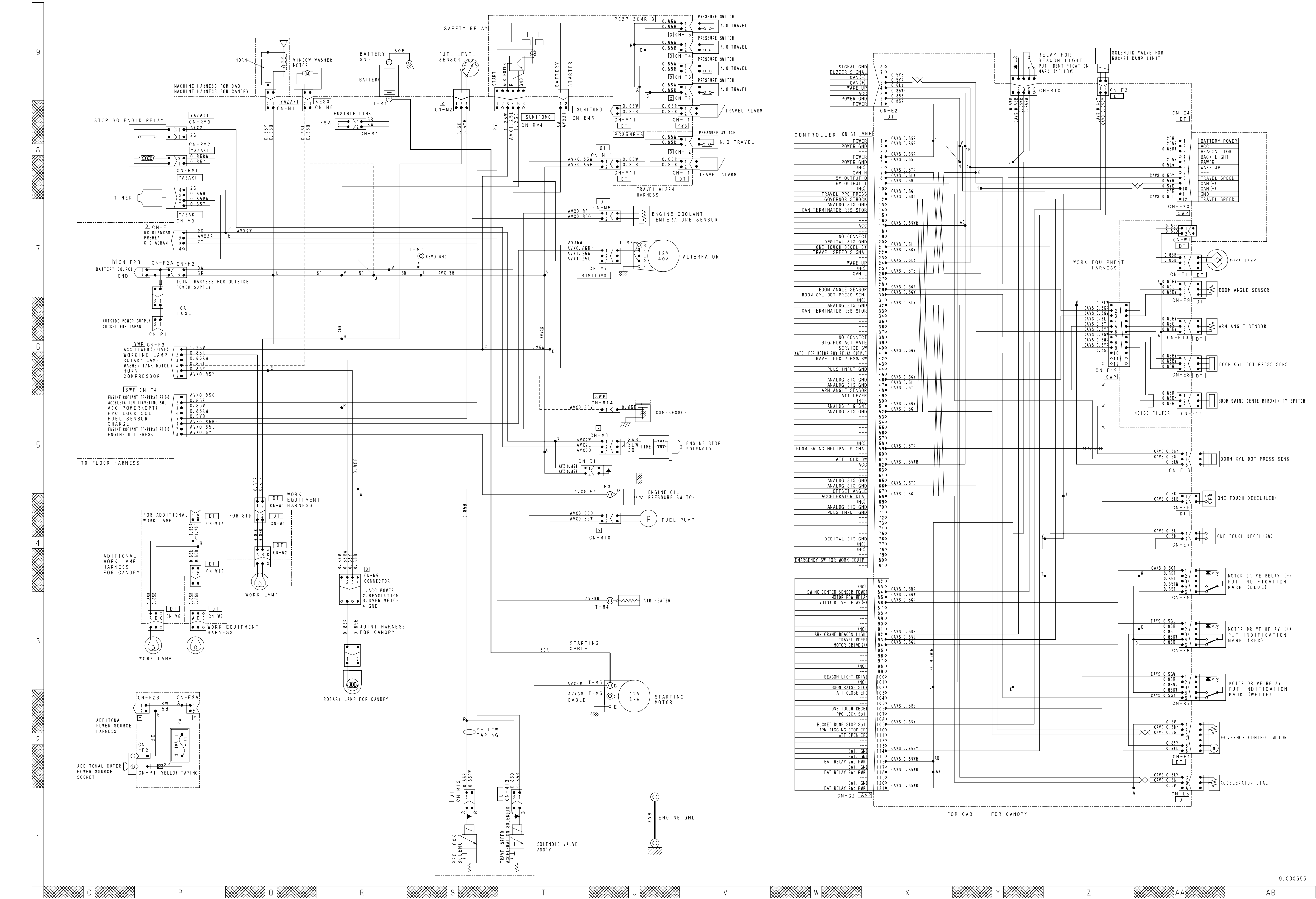
PC27MR-3, PC30MR-3, PC35MR-3



Electrical circuit diagram (2/4)

PC27MR-3, PC30MR-3, PC35MR-3

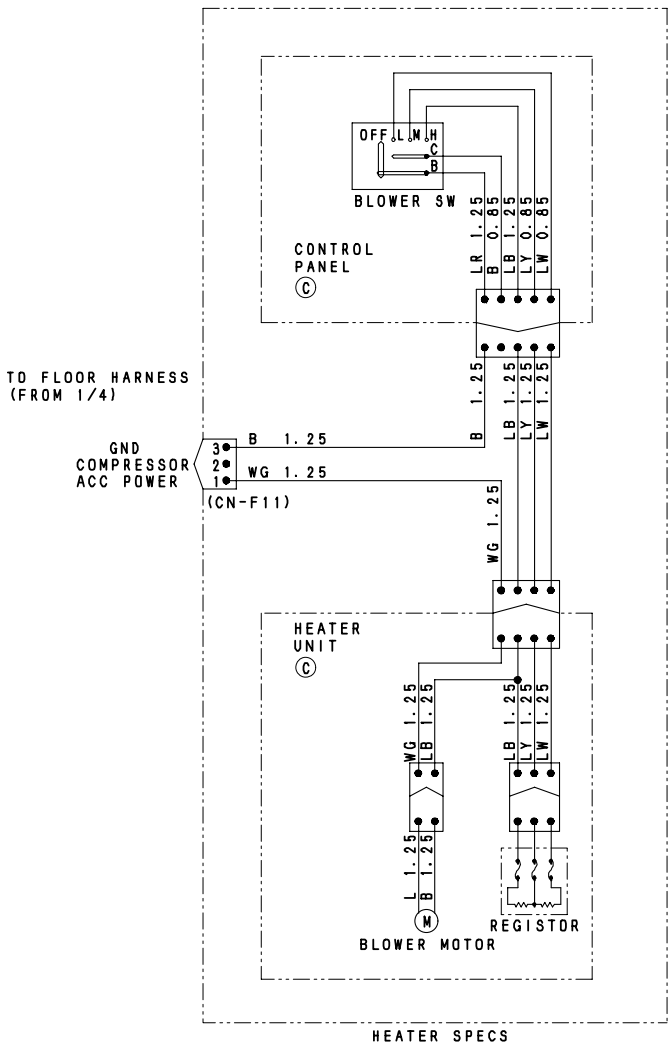
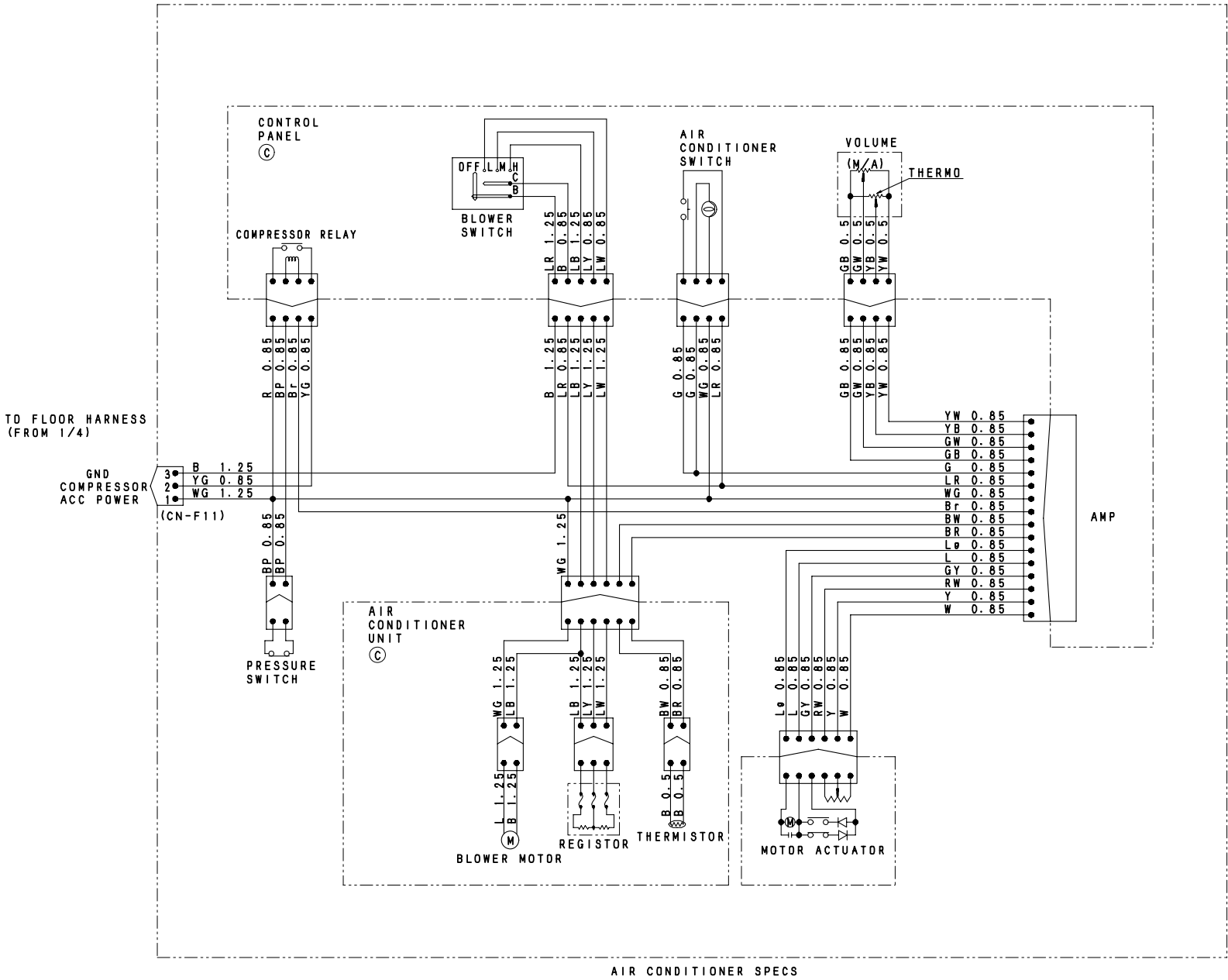
★ This figure covers the equipment and devices that are unavailable as optional items in some areas.



Electrical circuit diagram (3/4)

PC27MR-3, PC30MR-3, PC35MR-3

★ This figure covers the equipment and devices that are unavailable as optional items in some areas.

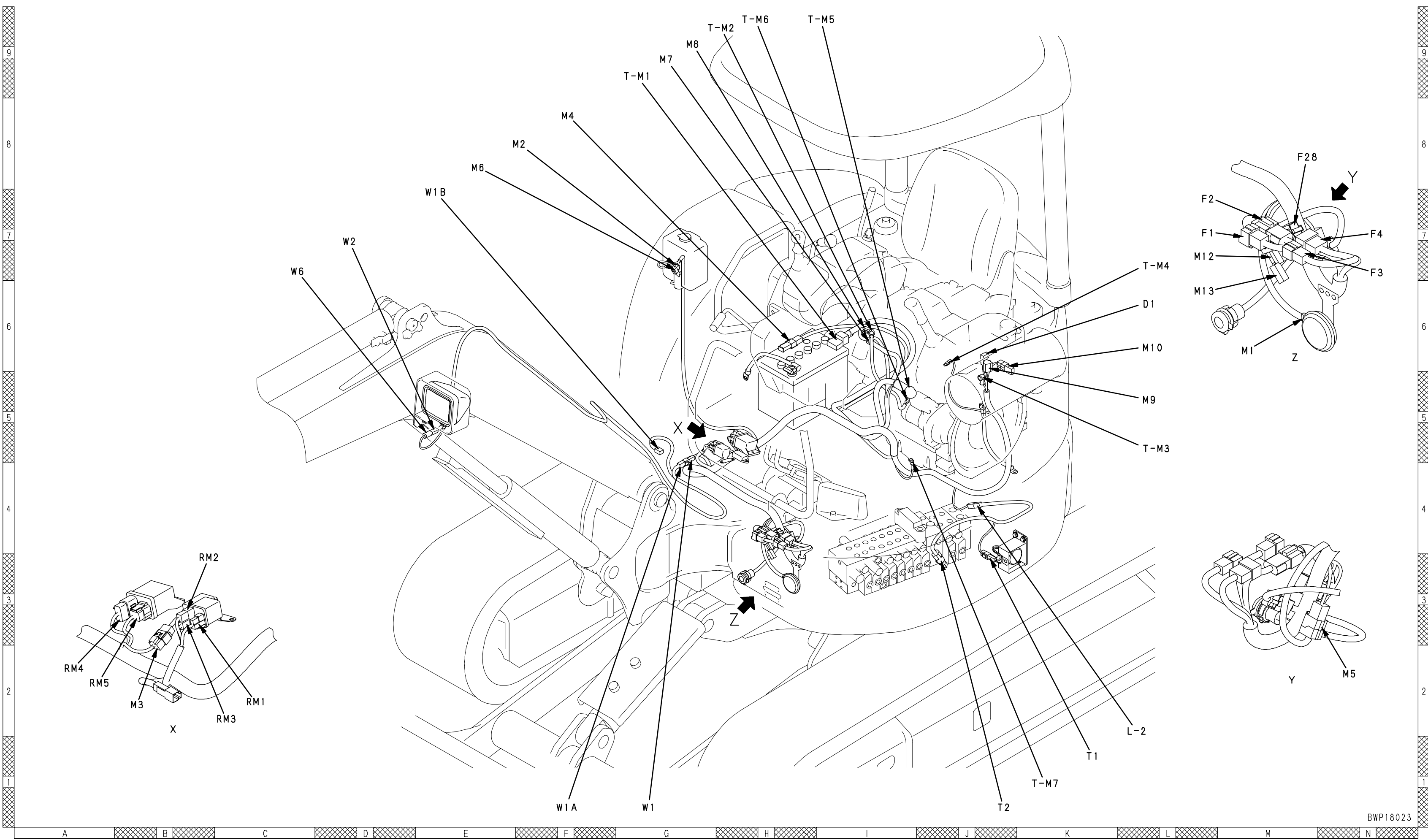


PC27MR-3, PC30MR-3, PC35MR-3

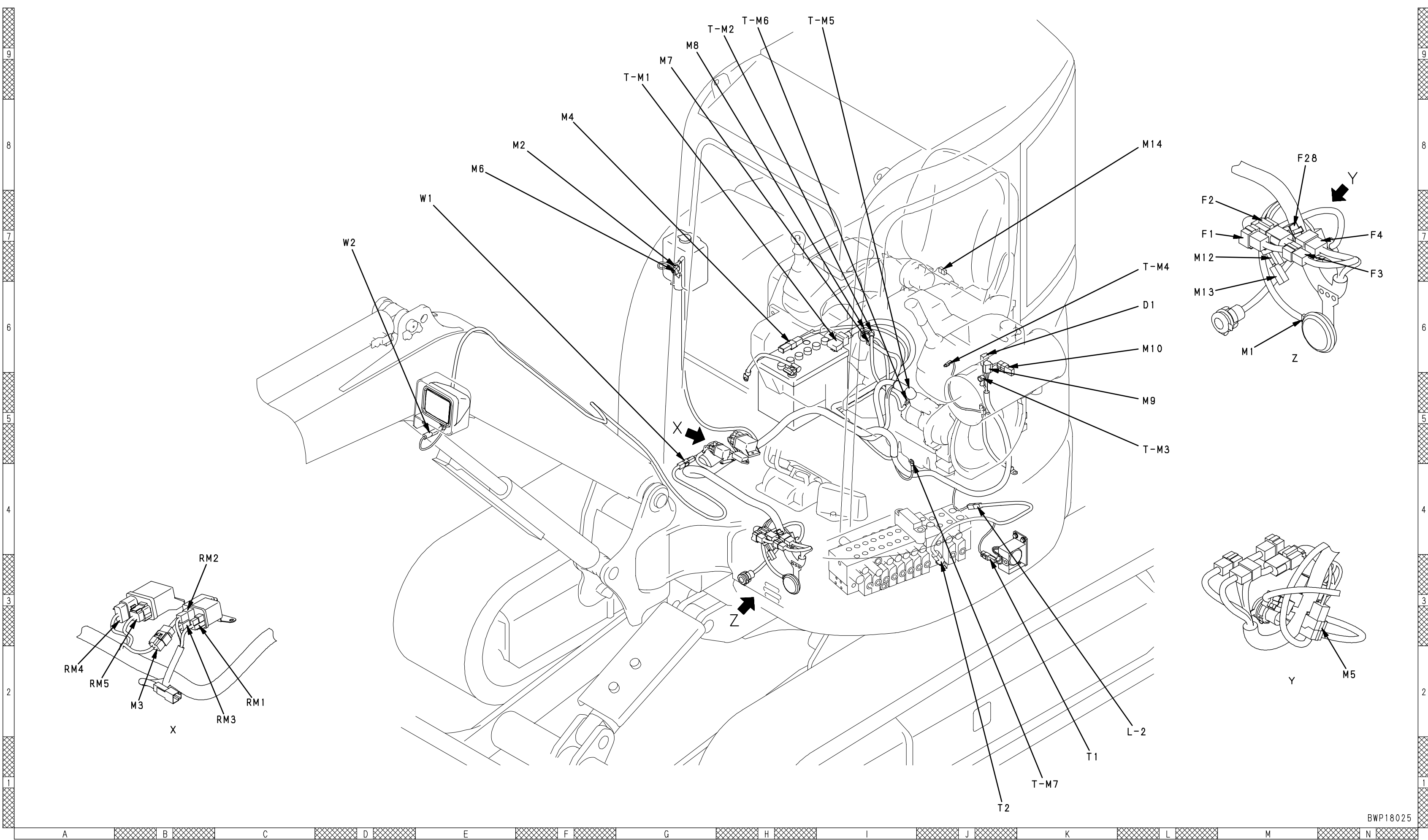
Connector list and stereogram PC27MR-3, PC30MR-3, PC35MR-3

Connector No.	Model	Number of pins	Component name	Address of stereogram	
				Canopy specification	Cab specification
D1	X	2	Diode (for engine stop solenoid)	L-6	L-6
D2	X	2	Diode (C terminal input)	S-8	T-9
F1	X	4	Intermediate connector (BR, C circuits)	L-7	L-7
F2	YAZAKI-Y	2	Intermediate connector (battery power supply circuit)	L-7	L-7
F3	SWP	6	Intermediate connector (harness between floor and machine)	N-7	N-7
F4	SWP	8	Intermediate connector (harness between floor and machine)	N-7	N-7
F5	DT-T	2	PPC lock switch (left)	T-6	T-5
F7	DT-T	4	Wiper motor [Cab specification]		O-3
F8	M	2	Intermediate connector (cigarette lighter) [Cab specification]		O-7
F9	DT-T	2	Optional power supply [Canopy specification]	R-9	
F11	KES1	3	Heater [Cab specification]		O-3
F12	KES1	4	Heater switch [Cab specification]		T-4
F13	YAZAKI090	2	Horn switch	O-6	O-5
F14	DT-T	2	PPC oil pressure lock switch [Canopy specification]	O-5	
F15	AMP070	20	Machine monitor	O-7	O-6
F16	KES0	2	Speaker (right) [Cab specification]		T-9
F17	PA	9	Radio [Cab specification]		O-6
F18	KES0	2	Speaker (left) [Cab specification]		T-5
F19	SUMITOMO	3	Room lamp [Cab specification]		Q-9
F20	SWP	12	Intermediate connector (main option harness)	T-5	T-4
F21	DT-T	2	Revolving warning lamp [Canopy specification, if equipped]	R-9	
F21	M	2	Revolving warning lamp [Cab specification, if equipped]		Q-9
F22	M	2	Intermediate connector (additional working lamp)		R-9
F22A	DT-T	2	Additional working lamp [Cab specification, if equipped]		Q-9
F22B	DT-T	2	Additional working lamp [Cab specification, if equipped]		S-9
F22C	DT-T	2	Additional working lamp [Cab specification, if equipped]		R-9
F23	M	3	Intermediate connector (radio) [Cab specification]		O-7
F24	M	3	Intermediate connector (wiper motor) [Cab specification]		Q-9
F25	Terminal	2	Cigarette lighter [Cab specification]		O-6
F28	M	2	Alarm buzzer	O-6, M-8	O-4, M-8
F29		10	Working lamp switch	T-5	T-4
F30	AMP070	18	KOMTRAX	S-8	T-9
F32	AMP070	12	KOMTRAX	T-8	T-8
F33	X	1	Test connector (male)	T-7	T-7
F34	X	1	Test connector (female)	T-7	T-7
F36	DT-T	3	Resistor (CAN circuit)	S-8	S-9
F37	DT-T	12	Service connector	T-4	T-3
F38	DT-T	2	Speedup switch	O-6	O-5
FB1	—	—	Fuse box	T-3	T-3
M1	YAZAKI	2	Horn	M-6	M-6
M2	X	2	Fuel level sensor	F-8	F-8
M3	YAZAKI	4	Timer (engine stop solenoid)	B-2	B-2
M4	M	2	Fusible link (45A)	F-8	F-8
M5	X	4	Intermediate connector (optional connector)	N-2	N-2
M6	KES0	2	Windshield washer motor [Cab specification]	E-8	E-8
M7	SUMITOMO	3	Alternator	G-9	G-9
M8	DT-T	2	Engine coolant temperature sensor	G-9	G-9
M9	X	3	Engine stop solenoid	L-5	L-5
M10	X	2	Fuel pump	L-6	L-6
M11	DT-T	2	Intermediate connector (travel alarm)	L-2	L-2
M12	DT-T	2	PPC lock solenoid	L-7	L-7
M13	DT-T	2	Travel speedup solenoid	L-6	L-6
M14	X	1	Air conditioner compressor [Cab specification]		L-8
R1	Relay	5	Starting motor cut relay	S-1	S-1
R2	Relay	5	PPC lock solenoid relay	S-1	S-1
R4	Relay	5	Travel speedup solenoid relay	T-2	T-2
R6	Relay	5	Starting motor cut relay (KOMTRAX)	T-2	T-2
RM1	YAZAKI	2	Engine stop solenoid relay	C-2	C-2
RM2	YAZAKI	1	Engine stop solenoid relay	B-3	B-3
RM3	YAZAKI	1	Engine stop solenoid relay	C-2	C-2
RM4	SUMITOMO	6	Safety relay	A-2	A-2
RM5	SUMITOMO	2	Safety relay	A-2	A-2
T1	DT-T	2	Travel alarm (if equipped)	K-1	K-1
T2	X	2	Travel pressure switch (if equipped)	J-1	J-1
T-F1	Terminal	1	Starting switch (B terminal)	P-9	O-9
T-F2	Terminal	1	Starting switch (BR terminal)	O-8	O-8
T-F3	Terminal	1	Starting switch (ACC terminal)	O-8	O-8
T-F4	Terminal	1	Starting switch (C terminal)	O-8	O-9
T-F5	Terminal	1	Starting switch (R1 terminal)	P-8	P-9
T-F6	Terminal	1	Starting switch (R2 terminal)	P-8	P-8
T-M1	Terminal	1	Battery (+ terminal)	G-9	G-9
T-M2	Terminal	1	Alternator (B terminal)	H-9	H-9
T-M3	Terminal	1	Engine oil pressure switch	L-5	L-5
T-M4	Terminal	1	Intake air heater	L-7	L-7
T-M5	Terminal	1	Starting motor (B terminal)	I-9	I-9
T-M6	Terminal	1	Starting motor (S terminal)	H-9	H-9
T-M7	Terminal	1	Revolving frame ground	K-1	K-1
W1	DT-T	2	Intermediate connector (working lamp)	G-1	E-7
W1A	DT-T	2	Intermediate connector (canopy specification, additional working lamp)	F-1	
W1B	DT-T	2	Intermediate connector (canopy specification, additional working lamp)	E-7	
W2	DT-T	3	Working lamp (installed to boom)	D-7	D-7
W6	DT-T	3	Additional working lamp [Canopy specification]	C-7	

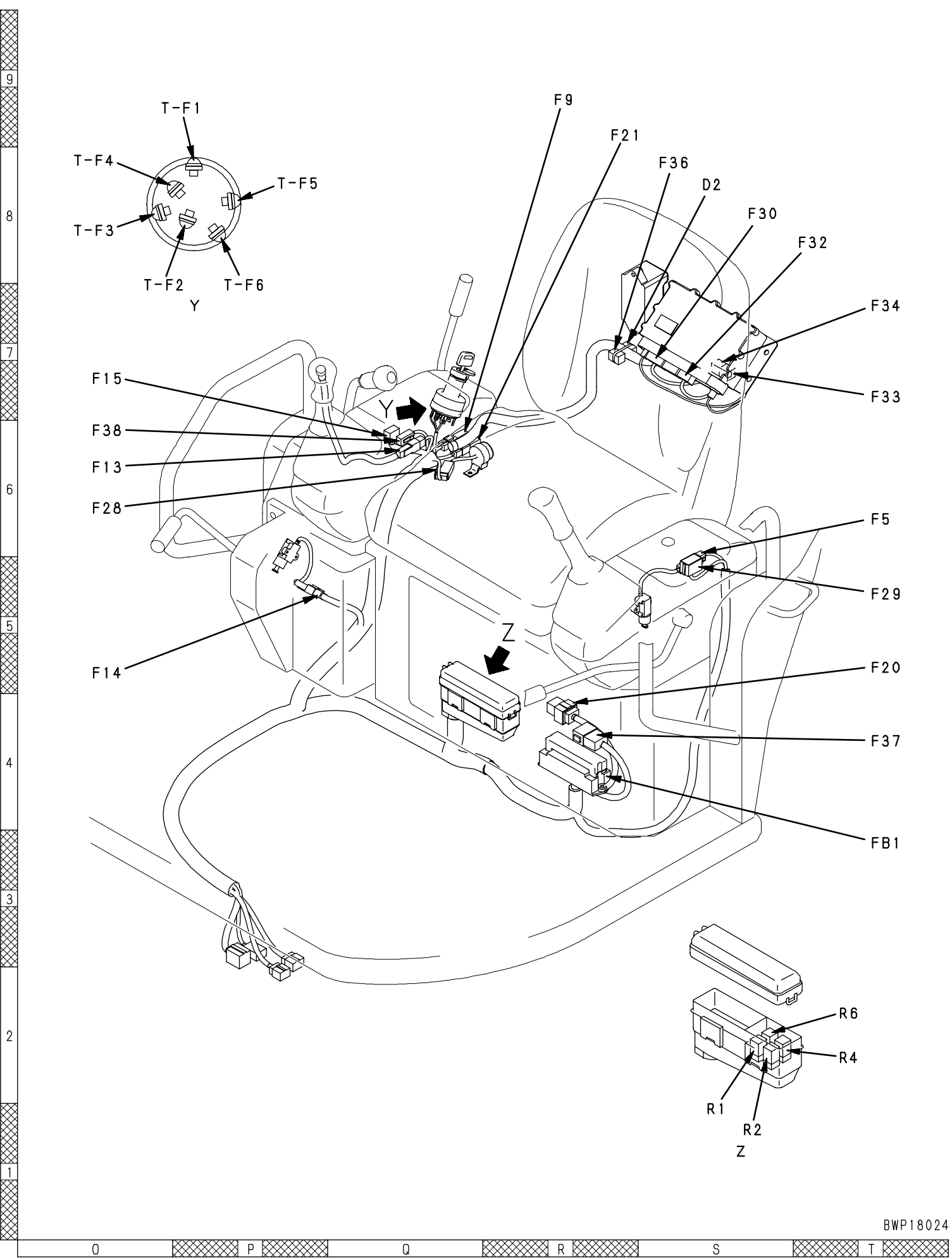
Canopy specification



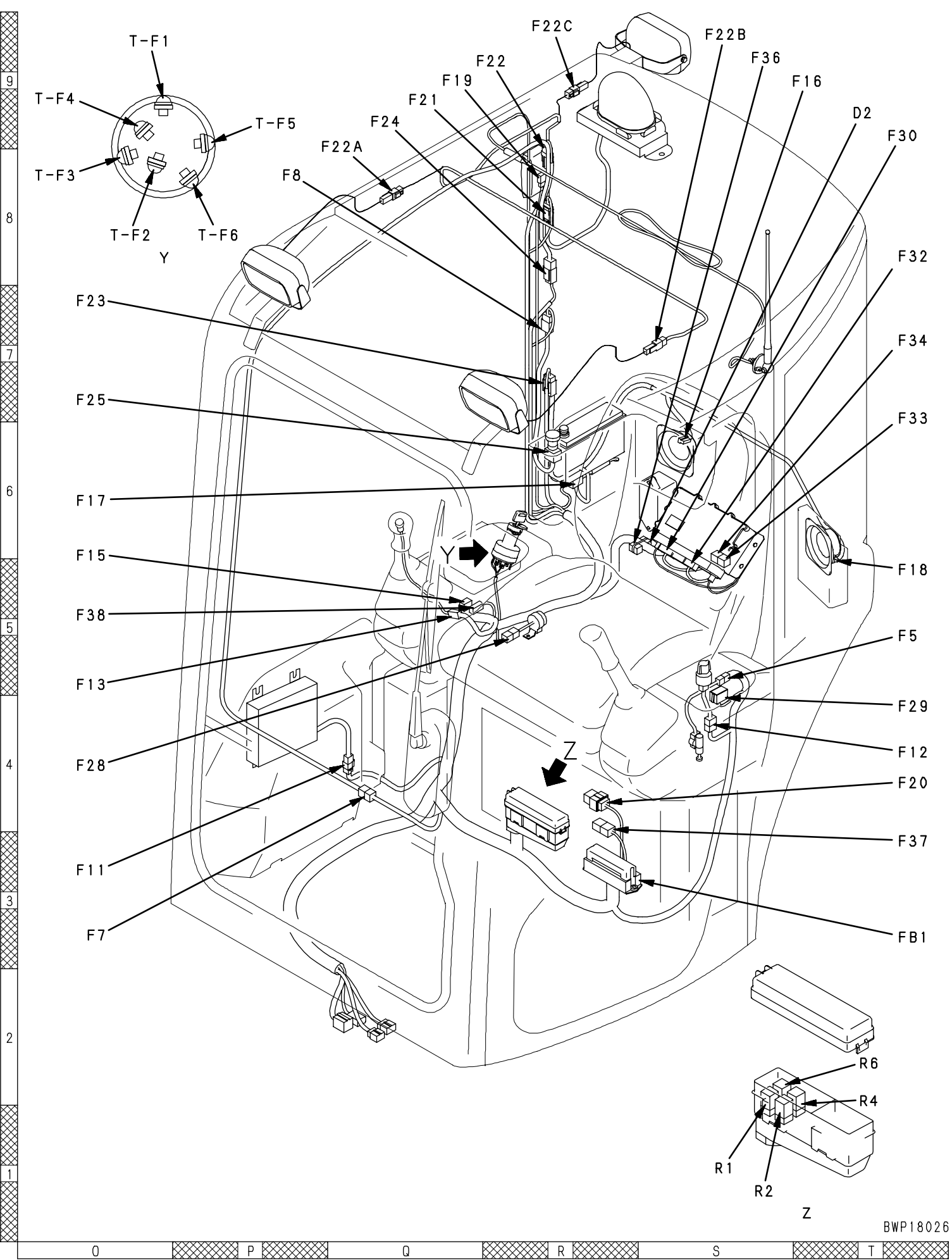
Cab specification



Canopy specification



Cab specification



PC27MR-3, PC30MR-3, PC35MR-3 Hydraulic excavator

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